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NATIONAL DAM INSPECTION REPORT. SUMMIT LAKE DAM (NDI ID NUMBER --ETC(U)
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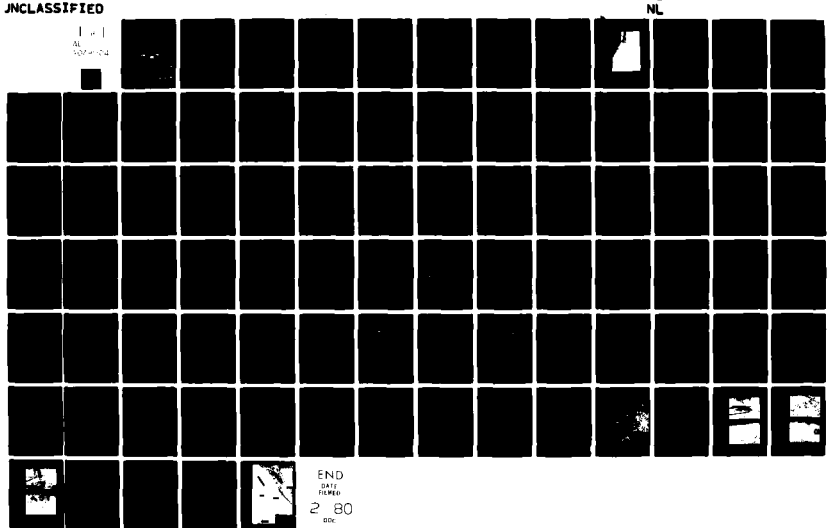

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SUSQUEHANNA RIVER BASIN
SUMMIT LAKE CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

SUMMIT LAKE DAM

NDI ID NO. PA-00291
DER ID NO. 35-26

PENNSYLVANIA GAS AND WATER COMPANY

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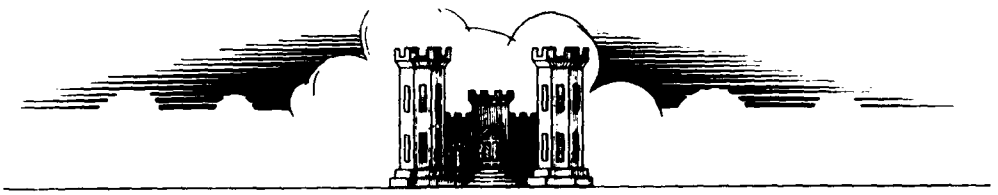

Prepared by
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
Harrisburg, Pennsylvania 17105

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For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

APRIL 1979

SUSQUEHANNA RIVER BASIN

SUMMIT LAKE CREEK, LACKAWANNA COUNTY

PENNSYLVANIA.

(6) National Dam Inspection Report.

SUMMIT LAKE DAM

(NDI ID No. PA-00291)
(DER-ID No. 35-26)

PENNSYLVANIA ~~GAS AND WATER COMPANY~~.

PHASE I INSPECTION REPORT.

NATIONAL DAM INSPECTION PROGRAM

(15) DACW31-79-C-0015

Prepared By

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
P.O. Box 1963
Harrisburg, Pennsylvania 17105

For

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

(11) APRIL 1979

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

SUSQUEHANNA RIVER BASIN

SUMMIT LAKE CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

SUMMIT LAKE DAM

NDI NO. PA-00291
DER ID No. 35-26

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

APRIL 1979

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B	Checklist - Visual Inspection.
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D	Photographs.
E	Geology.

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam:	Summit Lake NDI ID No. PA-00291/DER ID No. 35-26
Owner:	Pennsylvania Gas and Water Company
State Located:	Pennsylvania
County Located:	Lackawanna
Stream:	Summit Lake Creek
Date of Inspection:	26 October 1978
Inspection Team:	Gannett Fleming Corddry and Carpenter, Inc. Consulting Engineers P.O. Box 1963 Harrisburg, Pennsylvania 17105

Based on visual inspection, available records, calculations and past operational performance, and according to criteria established for these studies, Summit Lake Dam is rated as unsafe, nonemergency, because the spillway capacity is seriously inadequate. The existing spillway can pass 26 percent of the Probable Maximum Flood (PMF) without overtopping of the dam. The failure of the dam would cause an increased hazard to loss of life downstream. As a whole, the dam is judged to be in fair condition.

If the top of the dam were raised 0.1 foot to its design elevation, the spillway could pass 27 percent of the PMF. The spillway capacity would still be rated as seriously inadequate.

There is no evidence of stability problems with the embankment. The masonry gravity section of the

embankment has no significant deviations from the OCE guideline for stability, since the toe pressure is well below the allowable.

The following measures are recommended to be under-taken by the Owner, in approximate order of priority, immediately:

(1) Perform additional studies to more accurately ascertain the spillway capacity required for Summit Lake Dam and the remedial measures required to make the spillway hydraulically adequate. Perform remedial measures as required. The studies should be performed by a professional engineer experienced in the design and construction of dams.

(2) Raise the embankment to the design elevation of the top of the dam.

(3) Monitor with any suitable means the sagging spillway cascade steps. If changes are noted, take immediate remedial measures.

(4) Clear the spillway approach channel of rocks.

(5) Repair the mortar in the spillway and masonry gravity section. Repave the scoured area of the spillway.

(6) Replace the access bridge to the outlet works intake with a sturdier structure.

(7) As part of the regular maintenance program, remove brush, trees, and debris from the downstream toe. Also, fill the burrowing animal holes.

In addition, it is recommended that the Owner modify his operational procedures as follows:

(1) Develop a detailed emergency operation and warning system for Summit Lake Dam.

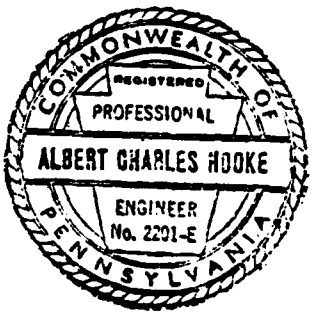
(2) Provide round-the-clock surveillance of Summit Lake Dam during periods of unusually heavy rains.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner

should activate his emergency operation and warning system procedures.

Submitted by:

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.



A. C. HOOKE
Head, Dam Section

Date: 30 April 1979

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

SUMMIT LAKE DAM

Overview

SUSQUEHANNA RIVER BASIN

SUMMIT LAKE CREEK, LACKAWANNA COUNTY

PENNSYLVANIA

SUMMIT LAKE DAM

NDI ID No. PA-00291
DER ID No. 35-26
PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

SECTION 1

PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Summit Lake Dam is a homogeneous earthfill embankment with a masonry wall along the downstream face. The wall extends up to the spillway crest elevation. The dam is 250 feet long and 24 feet high at maximum section.

The spillway is at the right abutment of the dam. It is a rectangular masonry channel extending

from the reservoir to the masonry wall, where a stepped masonry cascade discharges flows into the stream. The rectangular channel is 12.2 feet wide. At the control section, the invert is 4.3 feet below the design top elevation of the dam.

The outlet works consists of an intake structure and a 18-inch diameter cast-iron pipe. Access to the intake structure is via a bridge extending from the embankment. A 20-inch gate valve and 3 "mud" (flap) valves are provided in the intake structure. The various features of Summit Lake Dam are shown on the Plates at the end of the report and on the Photographs in Appendix D.

b. Location. The dam is located on Summit Lake Creek approximately 1.6 miles west of Chinchilla, Pennsylvania. Summit Lake Dam is shown on USGS Quadrangle, Scranton, Pennsylvania, with coordinates N41°28'30" - W75°42'50" in Lackawanna County, Pennsylvania. The dam is 1.1 miles upstream from Maple Lake Dam, which is on Summit Lake Creek. Maple Lake Dam releases water into La Rue Reservoir, which is 0.3 mile downstream from Maple Lake Dam. The location map is shown on Plate 1.

c. Size Classification. Small (24 feet high, 927 acre-feet).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high hazard classification is warranted for Summit Lake Dam (Paragraph 5.1c.).

e. Ownership. Pennsylvania Gas and Water Company, Wilkes-Barre, Pennsylvania.

f. Purpose of Dam. Water supply for Chinchilla, Pennsylvania and surrounding communities.

g. Design and Construction History. Summit Lake Dam was originally an earthfill embankment with a timber spillway. It was constructed in 1875. There is no other information available concerning this structure. Because of the large reservoir capacity, it is believed that Summit Lake was originally a natural lake. However, there is no information available to confirm this.

In 1884, the dam was enlarged by the Providence Gas and Water Company. The modification was designed

by C. S. Weston, Consulting Engineer of Scranton. The modifications altered the dam to its present configuration.

In 1910, a bulkhead was constructed across the spillway crest to raise it to within 2.4 feet of the top of the embankment. The concrete intake structure was also constructed at the same time.

In 1943, the bulkhead was removed and the spillway was returned to its post-1884 condition.

h. Normal Operational Procedure. The reservoir is normally maintained at spillway crest level. The valve on the outlet conduit is normally throttled partially open to supply water to the Owner's distribution system downstream at Maple Lake and La Rue Dams.

1.3 Pertinent Data.

a. Drainage Area. (square miles).	1.3
b. Discharge at Damsite. (cfs).	
Maximum known flood at damsite	Unknown
Outlet works at maximum pool elevation	42
Spillway capacity at maximum pool elevation	
Existing conditions	290
Design conditions	300
c. Elevation. (feet above msl).	
Top of dam (design)	1383.7
Top of dam (existing)	1383.6
Maximum pool	1383.6
Normal pool (spillway crest)	1379.4
Upstream invert outlet works	1361.8
Downstream invert outlet works	1360.0
Streambed at toe of dam	1360.0

d. Reservoir Length. (miles).

Normal pool	0.63
Maximum pool	0.64

e. Storage. (acre-feet).

Normal pool	645
Maximum pool	927

f. Reservoir Surface. (acres).

Normal pool	55.4
Maximum pool	69.6

g. Dam.

Type	Homogeneous earthfill with a masonry wall along the downstream side that extends up to spillway crest elevation.
Length (feet)	250
Height (feet)	24
Topwidth (feet)	8
Side Slopes	
Upstream	
Above spillway crest El.	1V on 2.6H
Below spillway crest El.	1V on 4.6H
Downstream	
Above top of masonry wall	1V on 4.5H
Below toe of masonry wall	Irregular, about 1V on 5H

	Zoning	Homogeneous earth-fill.
	Cutoff	Masonry wall.
	Grout Curtain	None.
h.	Diversion and Regulating Tunnel.	None.
i.	Spillway.	
	Type	Rectangular masonry control section.
	Length of Weir (feet)	12.2
	Crest Elevation	1379.4
	Upstream Channel	Rectangular masonry approach.
	Downstream Channel	Rectangular masonry channel extending to a stepped masonry cascade that discharges into the existing stream.
j.	Regulating Outlets.	
	Type	Tile clay pipe, 18-inch diameter. A 20-inch intake line extends to the intake structure.
	Length (feet)	102
	Closure	20-inch gate valve at intake structure.
	Access	Via bridge from embankment.

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. Very little engineering data were available for review for the original structures or for the modifications to the dam. In a study performed in 1914 by the Pennsylvania Water Supply Commission, an account of design concepts, geology, construction materials and methods, and design features was prepared from interviews with the Owner, visual inspection, and other sources. The available information is very limited. The 1914 study also included analyses for hydrology and hydraulics. A summary of the results of the analyses is on file. No information pertinent to the repairs accomplished in 1943 was available. This modification consisted of removing a previous modification and was probably accomplished without plans or specifications.

b. Design Features. The dam and appurtenances are described in Paragraph 1.2a. The design features are shown on the Plates at the end of the report and on the Photographs in Appendix D.

A plan of the dam is shown on Plate 2. The embankment is shown on Photographs A and D. Typical sections of the embankment, masonry section, and outlet works are shown on Plate 3. The downstream face of the masonry section is shown on Photograph B. The outlet works intake structure is shown on Photograph D; the outfall is shown on Photograph C. The spillway is shown on Plate 4 and on Photographs E and F.

The plates are not design drawings. The earliest drawing for the dam is dated 1901; according to information in the Pennsylvania Department of Environmental Resources (PennDER) files, some of the data on the drawings was obtained from drawings dated before 1901.

c. Design Considerations. Almost nothing is known about the design.

2.2 Construction.

a. Data Available. Construction data available for review for the original structures were limited to information contained in the 1914 Report prepared by the Pennsylvania Water Supply Commission. That information was obtained by interviews with the Owner, and it gives very scant details of the construction operations. The report classifies the available information as "of little value and unreliable".

b. Construction Considerations. Since the available construction data is limited, the construction methods cannot be assessed.

2.3 Operation. There are no formal records of operation. Based on information from the Owner and the caretaker of the dam, all structures have performed satisfactorily.

2.4 Evaluation.

a. Availability. Engineering data were provided by the Bureau of Dam Safety, Obstructions, and Storm Water Management, Department of Environmental Resources, Commonwealth of Pennsylvania (PennDER), and by the Owner, Pennsylvania Gas and Water Company. The Owner made available both a senior construction supervisor and the caretaker for information during the visual inspection. The Owner also researched his files for additional information upon request of the inspection team.

b. Adequacy. The type and amount of design data and other engineering data are limited, and the assessment must be based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the validity of the available data. Conflicting data concerning the masonry gravity wall at the downstream face of the embankment are discussed in Section 6.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The overall appearance of the dam is good, with some deficiencies as noted herein. The locations of deficiencies are shown in Appendix B on Plate B1. Survey data acquired during this inspection are presented in Appendix B. On the day of the inspection, the pool was 3.4 feet below spillway crest elevation.

b. Embankment and Masonry Gravity Section. The sod on the embankment is in excellent condition. On the upstream slope, the riprap does not extend to the top of the dam. The riprap is washed out in some areas and deteriorated in others (Photograph D). On the masonry gravity section, the mortar is deteriorated. Downstream of this section, the slope is irregular. Small trees and burrowing animal holes were observed; debris, probably from the intake structure bridge as discussed hereafter, covers the area (Photograph B). The survey performed for this inspection reveals that the embankment slopes are generally in accordance with the information shown on the Plates. The survey also reveals that approximately 50 percent of the top of the embankment is 0.1 foot below the design elevation (Appendix B). On the day of the inspection, no seepage was observed at the dam.

c. Appurtenant Structures. The outlet works is in good condition. On the day of the inspection, the outlet works valve was in a throttled position to release water to the stream below. The configuration of the outlet works did not allow observation of conditions at the outfall (Photograph C). The bridge extending from the embankment to the intake structure is in poor condition. The caretaker reported that the bridge is a replacement for a previous bridge that was damaged by vandalism and ice floes. The existing bridge is just above the spillway crest elevation and it is not sturdy. The remains of the previous bridge have apparently been placed at the toe of the masonry gravity section.

The spillway is in fair condition. The bottom of the approach channel is covered with loose rocks. The paved section between these rocks appeared to be somewhat irregular (Photograph E). The top of a concrete cutoff wall is visible just upstream of the control section. Near the control section, the bottom paving is cracked and a 1-foot by 3-foot area is eroded. The steps of the masonry cascade are sagging (Photograph F). The mortar in the entire spillway section is deteriorated.

d. Reservoir Area. The reservoir has generally gentle slopes. The watershed has minor development. A country club with a golf course and some widely spaced suburban development are within the watershed. Access to the dam is via a short road, which parallels the reservoir and is above it.

e. Downstream Channel. The stream flows from the dam for 0.1 mile by a poultry farm and then for 0.3 mile by some dwellings within the floodplain. In the above reach, the stream passes through some small culverts under low roadway embankments. The stream then flows for 0.9 mile along a reach within which are Maple Lake and La Rue Dams. Between Maple Lake Dam and La Rue Dam are a few low lying homes. The stream then flows 0.3 mile through part of Chinchilla to its confluence with Leggetts Creek. In Chinchilla, some dwellings and commercial establishments are directly adjacent to the stream, which passes through some small culverts.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at spillway crest, Elevation 1379.4, with excess inflow discharging over the spillway and into the stream, which flows into Maple Lake Reservoir 1.1 miles downstream. An 18-inch diameter tile-clay pipe discharges water from the reservoir. Flows in the line are regulated by a 20-inch valve at the intake structure. Streamflows into Maple Lake Dam can be increased by releases from Summit Lake Dam. Since Maple Lake Dam functions as an intake reservoir, the valve on the Summit Lake water discharge line is usually in the throttled position.

4.2 Maintenance of Dam. The dam is visited daily by a caretaker who records the reservoir elevation and adjusts the outlet works valves. Weekly reports are mailed to the Owner's Engineering Department. This information is used by the Owner's Engineering Department for regulating flows in the distribution system. The caretaker is also responsible for observing the general condition of the dam and appurtenant structures and for reporting any changes or deficiencies to the Owner's Engineering Department. A Pennsylvania Gas and Water Company engineer makes a formal inspection of the dam each year, and the records are filed and used for determining the priority of repairs. Informal inspections are also made when the engineer is on the site for other reasons. The grass on the embankment is mowed frequently.

4.3 Maintenance of Operating Facilities. The valve on the outlet works pipe is operated frequently. In response to the Phase I Dam Inspection Program of the previous year, the Owner is revising his maintenance procedures. Details of the procedures are still being developed.

4.4 Warning Systems in Effect. The Owner furnished the inspection team with a verbal description of the chain of command for Summit Lake Dam and of a generalized

emergency notification list that is applicable for all of the Pennsylvania Gas and Water Company dams. The Owner said that during periods of heavy rainfall, available personnel are dispatched to the dams to observe conditions. All company vehicles are equipped with radios, and the personnel can communicate with each other and with a central control facility. Evaluation of risk is made by the Owner's Engineering Department. The Owner's Engineering Department is also responsible for notification of emergency conditions to the local authorities. Detailed emergency operational procedures have not been formally established for Summit Lake Dam, but are as directed by the Owner's Engineering Department.

4.5 Evaluation of Operational Adequacy. The maintenance of the embankment is generally good. The maintenance procedures for the outlet works valve are adequate. The procedures used by the Owner for inspecting the dam are adequate, but some needed repairs have not been made. In general, the warning system is adequate, but it would be more effective if it were more detailed.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features

a. Design Data. No design data were available for review. During 1914, a report on the dam was made by the Pennsylvania Water Supply Commission. This study resulted in no recommendations. The spillway was modified to its present configuration in 1943. An analysis of the spillway modification by the Pennsylvania Water Power Commission is available in the PennDER records. In this analysis, the spillway capacity was estimated at 288 cfs with the embankment at design elevation. In a report, dated 1944, Thomas H. Wiggin, consulting engineer of New York City, estimated the discharge capacity of the spillway at 225 cfs. As was noted in a review of the study by the Commonwealth, the dimensions used in the study do not agree with the dimensions of the existing spillway. Furthermore, the coefficient of discharge used in the study was 1.5. Based on calculations made for this study, a spillway discharge capacity of 290 cfs for existing conditions and 300 cfs for design conditions is used in this report (Appendix C).

b. Experience Data. The Owner has not reported any hydraulic problems with the dam. He does not have any experience data concerning flows during times of flood.

c. Visual Observations.

(1) General. The visual inspection of Summit Lake Dam, which is described in Section 3, resulted in a number of observations relevant to hydrology and hydraulics. These observations are evaluated herein for the various features.

(2) Embankment. The low area on the top of the embankment reduces the spillway discharge capacity. The riprap not extending to the top of the dam presents an erosion hazard when the pool is above spillway crest elevation. Judging by the washout and deterioration of the existing riprap, little protection is provided by it.

(3) Appurtenant Structures. Except for the condition of the access bridge, no deficiencies were observed at the outlet works; upstream closure is provided by the valve in the intake structure. The condition of the bridge indicates that it could be damaged by high pool or ice floe conditions. Access to the intake structure would then be difficult.

The conditions in the approach channel to the spillway will reduce spillway discharges when the pool is just above the spillway crest elevation. This would not significantly affect the higher spillway discharges.

(4) Reservoir Area. No conditions were observed in the reservoir area or watershed that might present a significant hazard to the dam. The assessment of the dam is based on existing conditions, and the effects of future development are not considered. Access to the dam is good.

(5) Downstream Conditions. No conditions were observed immediately downstream of the dam that might present a significant hazard to the dam. The downstream conditions indicate that many dwellings could be flooded by a failure of Summit Lake Dam. Both Maple Lake and La Rue dams are sufficiently small that they would not provide significant mitigating effects to floodflows originating upstream. Their failure would not significantly increase the hazards caused by the failure of Summit Lake Dam. The downstream conditions indicate that a high hazard classification is warranted for Summit Lake Dam.

d. Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE) for the size (Small) and hazard potential (High) of Summit Lake Dam, the spillway design flood (SDF) is between one-half of the probable maximum flood (PMF) and the PMF. Since there are at least 20 dwellings downstream, the PMF is selected as the SDF for Summit Lake Dam.

(2) Description of Model. The watershed was modeled with the HEC-1DB computer program. The HEC-1DB computer program computes a PMF runoff hydrograph and routes the flows through both reservoirs and stream sections.

In addtion, it has the capability to simulate an overtopping dam failure. The PMF inflow to Summit Lake was determined and routed through the dam. Identical methods were used for various percentages of the PMF.

(3) Summary of Results. Pertinent results are tabularized at the end of Appendix C. The Analysis reveals that Summit Lake Dam, with its existing top elevation of 1383.6, can pass approximately 26 percent of the PMF without overtopping.

If Summit Lake Dam were raised to its design elevation of 1383.7, it would be able to pass approximately 27 percent of the PMF.

(4) Spillway Adequacy. The criteria used to rate the spillway adequacy of a dam are described in Appendix C. Since the spillway cannot pass the 1/2 PMF without the overtopping of the dam, a furter analysis was performed. It was assumed that Summit Lake Dam would develop an 80-foot wide breach 0.1 hour after being overtopped by 0.3 foot. A breach of this size results in a peak outflow of 32,600 cfs. The breach outflow was routed downstream. It was assumed that no runoff occurred downstream from Summit Lake Dam. The dam failure outflow would raise the stream depth above the depth that would occur without failure of the dam by 5.1 to 10.2 feet. There is an increased hazard to loss of life. The spillway is rated as seriously inadequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Summit Lake Dam, which is described in Section 3, resulted in a number of observations relevant to structural stability. These observations are evaluated herein for various features.

(2) Embankments. Trees and brush growing at the embankment are undesirable. Burrowing animal holes are also undesirable. The debris at the toe of the masonry gravity section is not a hazard to the dam except that it hinders visual inspection. The top of the dam being slightly below the design elevation is probably due to settlement. The deteriorated mortar in the masonry gravity section is an indication of lack of maintenance.

(3) Appurtenant Structures. No deficiencies of structural significance were observed at the outlet works. Most of the deficiencies at the spillway are an indication of lack of maintenance. The sagging of the cascade steps is of some concern. It is believed that this could have been caused by poor construction practice or foundation problems. As the construction information is very limited, the cause cannot be ascertained without further investigation. The 1914 Pennsylvania Water Supply Commission Report notes that in 1911 one of the walls along the cascade had to be reset because it had settled. The Report indicated that the spillway cascade is founded on earth.

b. Design and Construction Data. No record of design data or stability analysis was available for review. Analysis of the embankment stability is beyond the scope of this study. Also, sufficient data on the engineering properties of the embankment material would have to be acquired before the analysis could be performed. There is no evidence of stability problems with the embankment.

The dimensions of the masonry gravity section are in doubt. The following is an excerpt from the Pennsylvania Water Supply Commission Report.

> "The information available on the original dam, the changes made when the dam was increased in height and the method of construction is of little value and unreliable. Mr. Cox tried to obtain information from several men who lived in the vicinity of the dam, but was not successful, and on my last trip to Scranton I interviewed Mr. C. S. Weston and even he remembered very little about what actually took place. He gave me to understand that a few sections of the wall that were traced from a drawing in his possession do not show how the wall was actually constructed and that they were only proposed sections..... According to Mr. Weston, the wall was carried deeper and made heavier than shown on the drawing and, so far as he could recollect, it was founded on hardpan. After a trench had been excavated in the outer prism of the earthen embankment the masonry wall was built and the trench back filled with selected material which was puddled and tamped. The reason for the odd location was to keep down the amount of earth that had to be handled."

Mr. Weston was the designer of the 1884 modification to the dam. Apparently the Pennsylvania Water Supply Commission considered that the masonry gravity section was a corewall; it was never analyzed by them.

The highest section of the masonry gravity wall that is shown on Plate 3 was analyzed for this study. Plate 3 was drawn after 1909. It is unsure whether the wall shown on the upper plate is the heavier section referenced above. The stability analysis was performed for the wall, assuming a water level at the top of the wall, full hydrostatic head and at-rest earth pressure on the upstream face, no tailwater, and uplift varying from zero at the toe to two-thirds the headwater at the heel. For this loading condition, the resultant is within the base, but outside of the middle third, about 1.8 feet from the toe, and both the factor of safety against sliding and the toe pressure are within acceptable limits. The OCE guideline for stability states that the resultant should be within the middle

third. The resultant being outside the middle third is not considered to be a significant deviation from the OCE guideline, since the toe pressure is well below the allowable.

Although information about the structure is uncertain, the available information indicates that the structure may be more massive than indicated; this would improve its stability. As such, there is no concern about its stability.

c. Operating Records. There are no formal records of operation. According to the Owner, no stability problems have occurred over the operational history of the dam.

d. Postconstruction Changes. As noted herein, very little information was available for the various modifications to the dam. However, the modifications were made sufficiently long ago that the embankment, as it exists, is the basis for the evaluation.

e. Seismic Stability. Summit Lake Dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone has adequate factors of safety under static loading conditions, it can be assumed safe for any expected earthquake loading. However, since there are no formal static stability analyses, and since there is the possibility of earthquake forces cracking the masonry gravity section, the theoretical seismic stability of Summit Lake Dam is not known.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND
PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety.

(1) Based on the visual inspection, available records, calculations, and past operational performance, Summit Lake Dam is judged to be in fair condition. However, the existing spillway will pass only 26 percent of the PMF without overtopping of the dam. The failure of the dam will increase the hazard to loss of life downstream. The spillway is rated as seriously inadequate. According to criteria established for these studies, the dam must be rated as unsafe because the spillway capacity is seriously inadequate.

If the embankment were raised to its design elevation, the spillway would be able to pass 27 percent of the PMF. The spillway capacity would still be rated as seriously inadequate.

(2) There is no formal stability analysis available for Summit Lake Dam. However, there is no evidence of problems threatening the stability of the embankment. The masonry gravity section has its resultant outside the middle third but within the base; this is not judged to be a significant deviation from the OCE guideline, since the toe pressure is well below the allowable.

(3) The visual inspection revealed some deficiencies, which are summarized below for the various features.

Feature and Location	Observed Deficiencies
Embankment:	
Top	Below design elevation.
Upstream slope	Riprap does not extend to the top of the dam; it is deteriorated and washed out in areas.

Feature and Location	Observed Deficiences
Downstream toe	Brush, debris, and burrowing animal holes.
Masonry gravity section	Deteriorating mortar.
Outlet Works:	
Access bridge	Insufficient strength.
Spillway:	
Approach channel	Loose rocks.
Control section	Crack and scour.
Cascade	Sagging steps.
Walls and paving	Deteriorated mortar.

b. Adequacy of Information. The information available is such that an assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed prior to and as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented immediately.

d. Necessity for Further Investigations. In order to accomplish some of the remedial measures outlined in Paragraph 7.2, further investigations by the Owner will be required.

7.2 Recommendations and Remedial Measures.

a. The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Perform additional studies to more accurately ascertain the spillway capacity required for Summit Lake Dam and the remedial measures required to make the spillway hydraulically adequate. Perform remedial measures as required. The studies should be performed by a professional engineer experienced in the design and construction of dams.

(2) Raise the embankment to the design elevation of the top of the dam.

(3) Monitor with any suitable means the sagging spillway cascade steps. If changes are noted, take immediate remedial measures.

(4) Clear the spillway approach channel of rocks.

(5) Repair the mortar in the spillway and masonry gravity section. Repave the scoured area of the spillway.

(6) Replace the access bridge to the outlet works intake with a sturdier structure.

(7) As part of the regular maintenance program, remove brush, trees, and debris from the downstream toe. Also fill the burrowing animal holes.

b. In addition, it is recommended that the Owner modify his operational procedures as follows:

(1) Develop a detailed emergency operation and warning system for Summit Lake Dam.

(2) Provide round-the-clock surveillance of Summit Lake Dam during periods of unusually heavy rains.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system procedures.

SUSQUEHANNA RIVER BASIN

SUMMIT LAKE CREEK LACKAWANNA COUNTY

PENNSYLVANIA

SUMMIT LAKE DAM

NDI ID No. PA-00291
DER ID No. 35-26

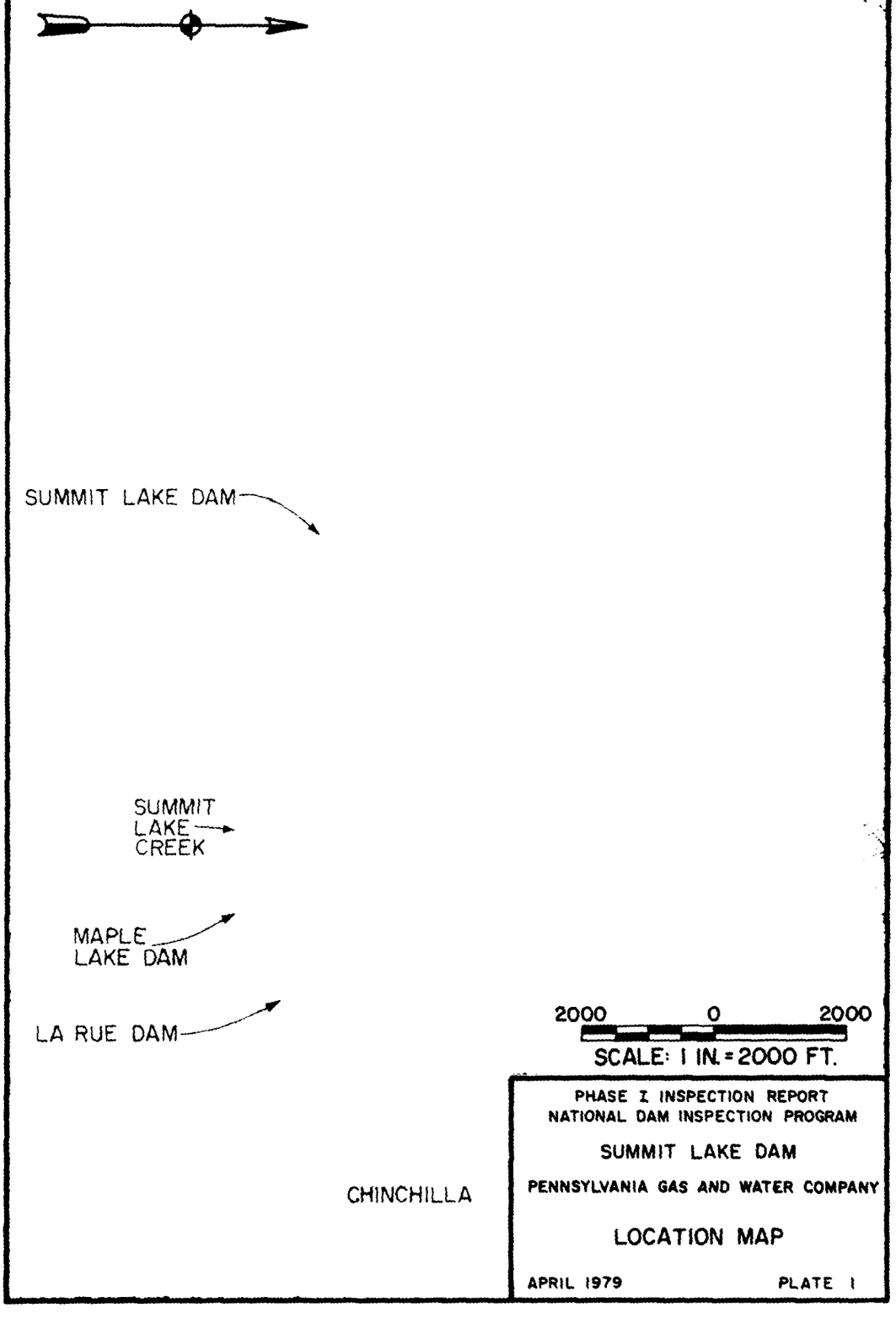
PENNSYLANIA GAS AND WATER COMPANY

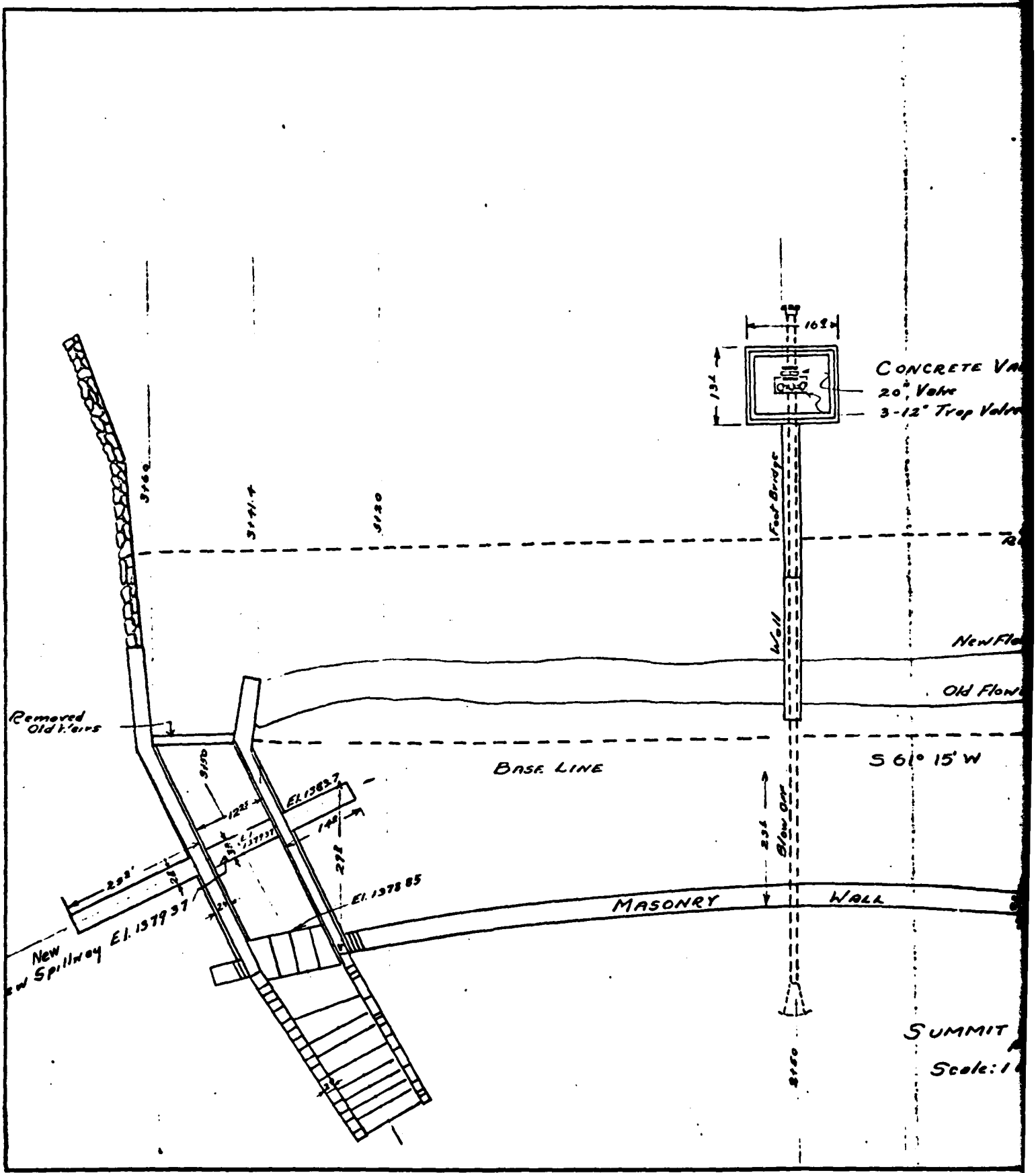
PHASE I INSPECTION REPORT

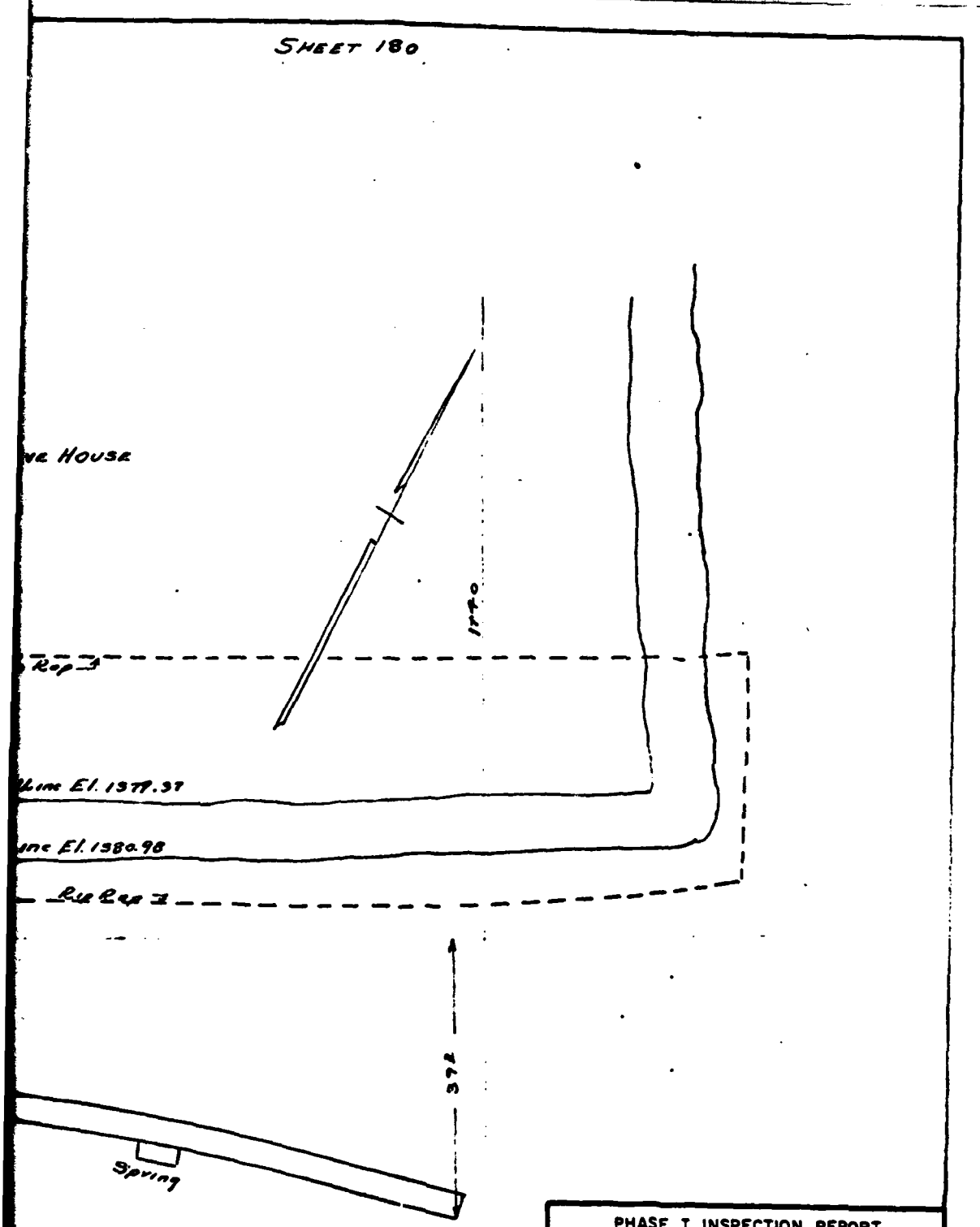
NATIONAL DAM INSPECTION PROGRAM

APRIL 1979

PLATES


SUMMIT LAKE DAM
SUMMIT LAKE CREEK
MAPLE LAKE DAM
LA RUE DAM
CHINCHILLA
2000 0 2000
SCALE: 1 IN. = 2000 FT.
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
SUMMIT LAKE DAM
PENNSYLVANIA GAS AND WATER COMPANY
LOCATION MAP
APRIL 1979
PLATE 1


Concrete Va
20" Valve
3-12" Trap Valve
Foot Bridge
Wall
New Flo
Old Flow
Removed Old Piers
Base Line
S 61° 15' W
El. 1383.7
El. 1378.85
El. 1379.37
New Spillway El. 1379.37
Masonry
Wall
Blow Off
Summit
Scale: 1



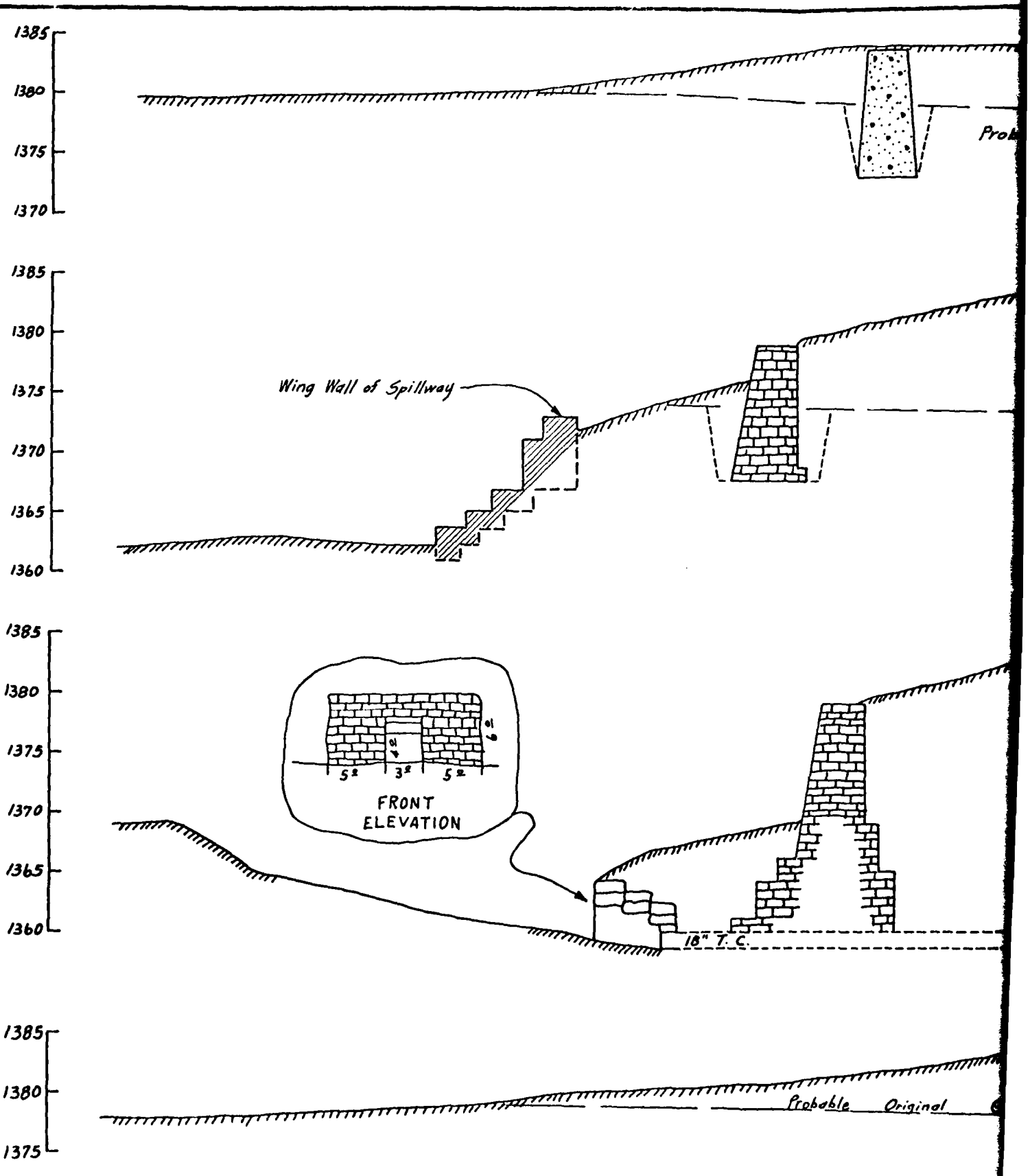
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

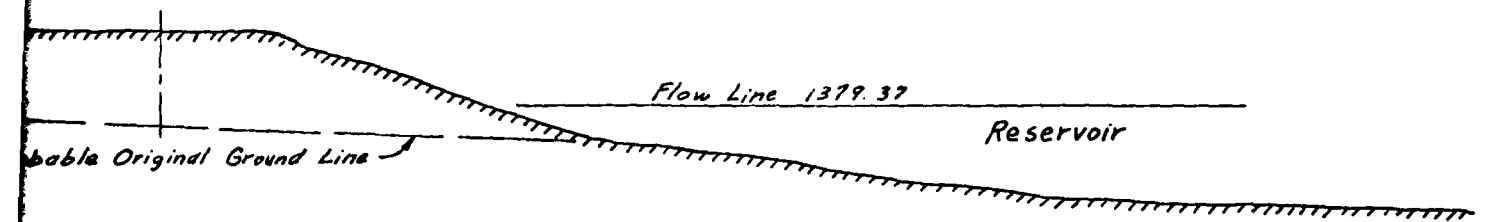
SUMMIT LAKE DAM

PENNSYLVANIA GAS AND WATER COMPANY

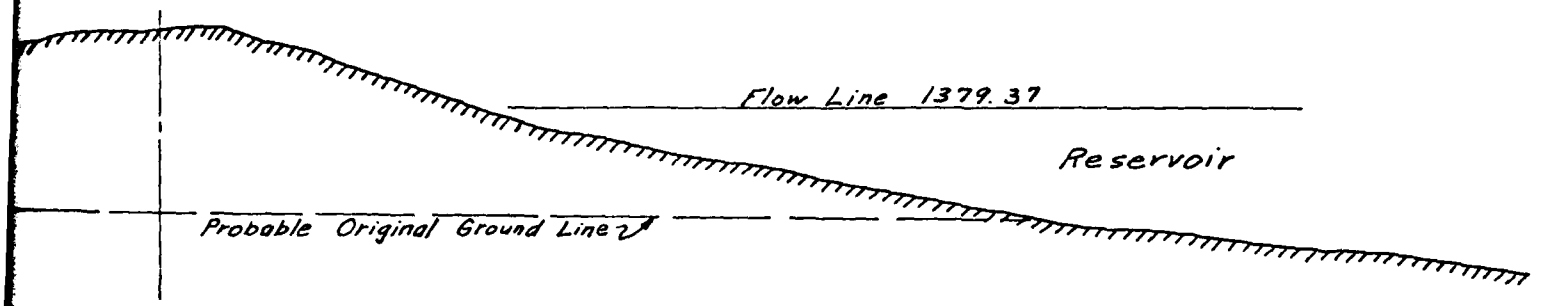
PLAN

APRIL 1979 PLATE 2


1385
1380
1375
1370
Prob
1385
1380
1375
1370
1365
1360
Wing Wall of Spillway
1385
1380
1375
1370
1365
1360
5'
3'
5'
10'
FRONT
ELEVATION
18" T. C.
1385
1380
1375
Probable Original



3+60



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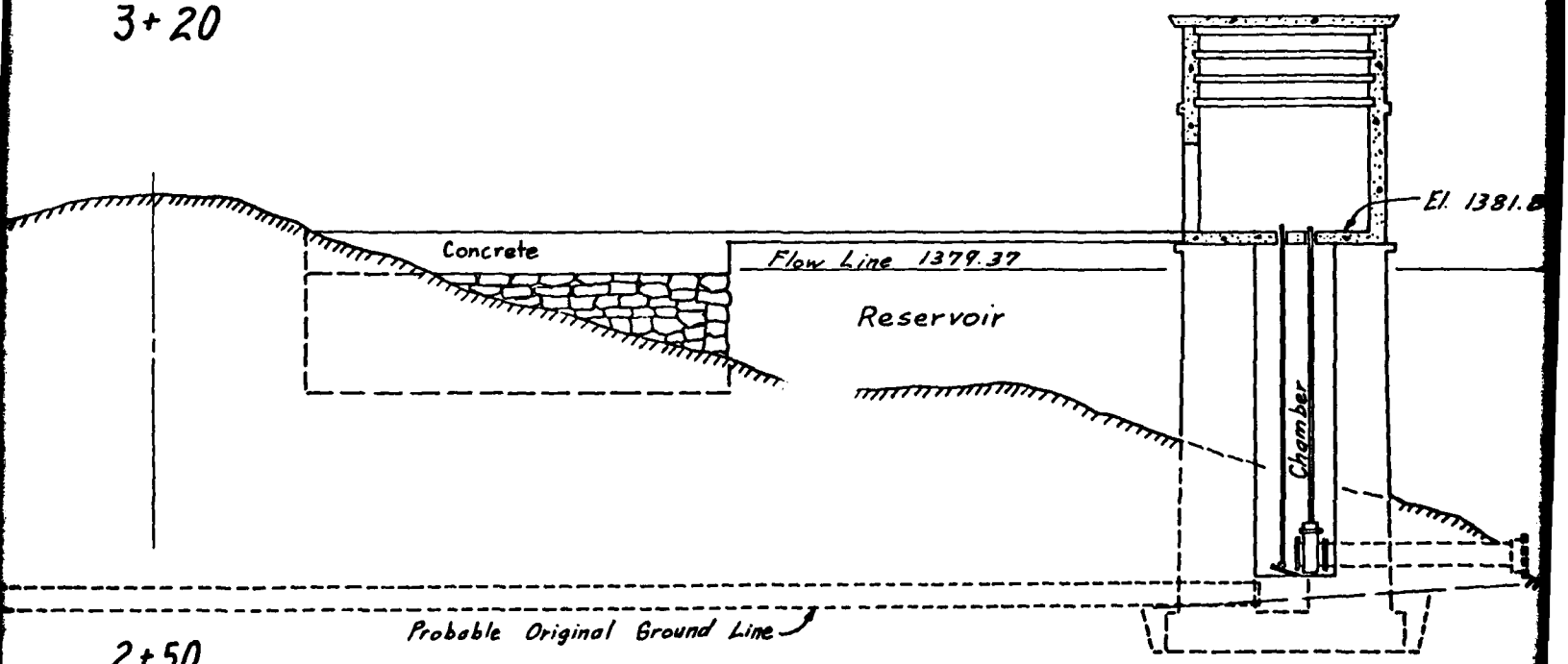
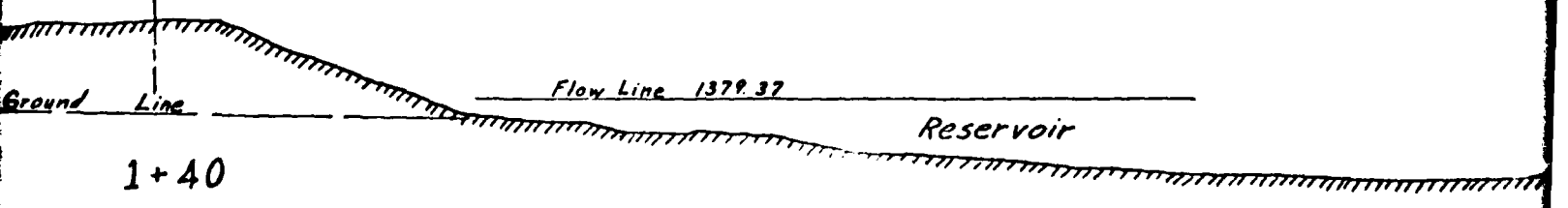


2+50



1+40

NOTE:
This drawing was traced from owner's original drawing.

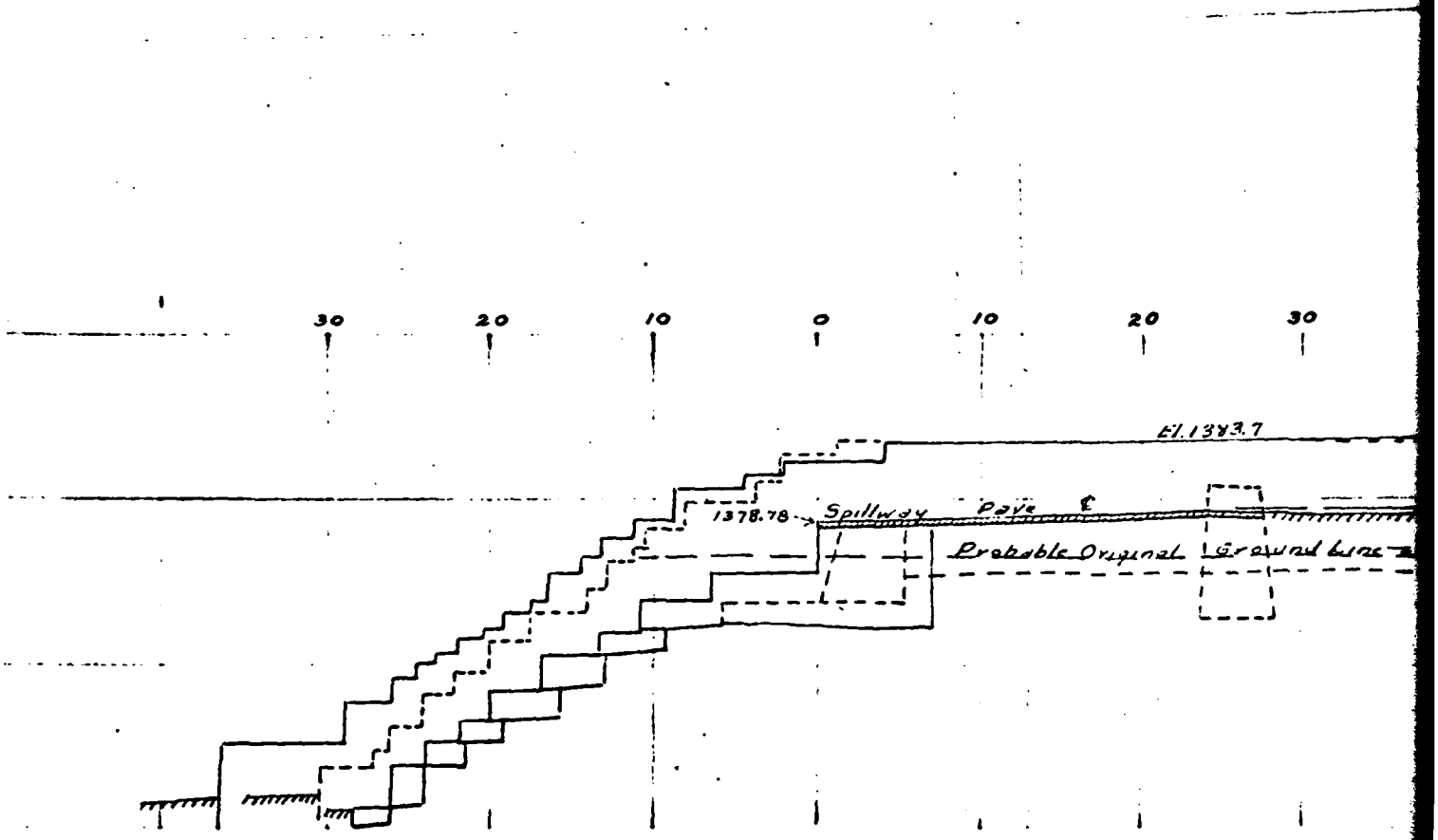
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

SUMMIT LAKE DAM

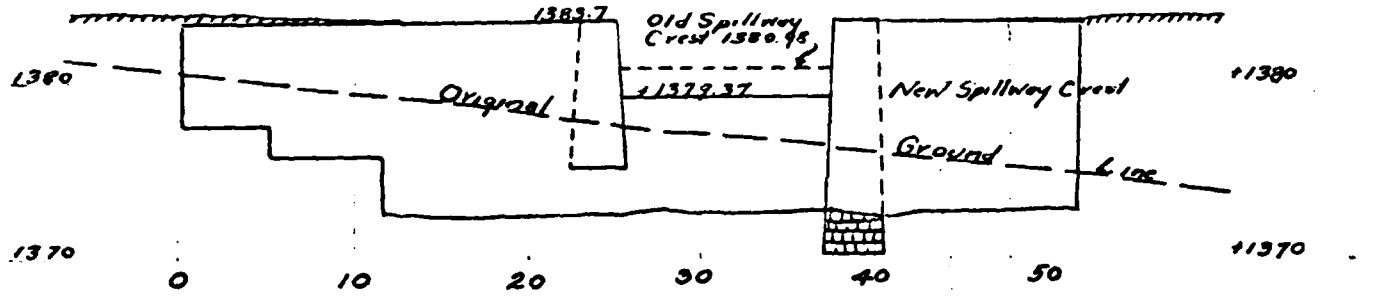
PENNSYLVANIA GAS AND WATER COMPANY

SECTIONS AND OUTLET WORKS

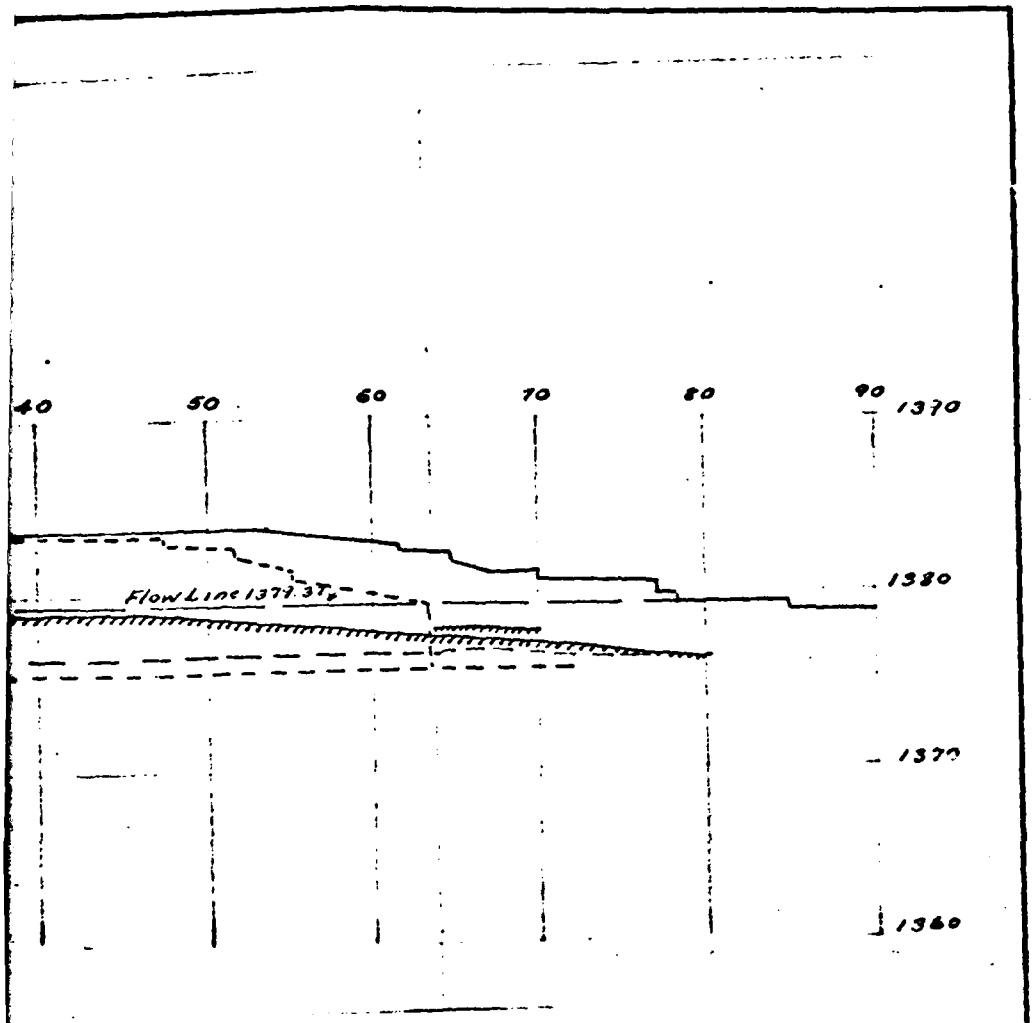
APRIL 1979 PLATE 3



SPILLWAY SECTION
SCALE: 1 INCH = 10 FEET



LONGITUDINAL SECTION
OF SPILLWAY AND CUT OFF WALL - LOOKING NORTH
Scale: 1 Inch = 10 Feet



SUMMIT LAKE
(AFTER SPILLWAY LOWERING IN 1943

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

SUMMIT LAKE DAM

PENNSYLVANIA GAS AND WATER COMPANY

SPILLWAY

APRIL 1979 PLATE 4

SUSQUEHANNA RIVER BASIN

SUMMIT LAKE CREEK LACKAWANNA COUNTY

PENNSYLVANIA

SUMMIT LAKE DAM

NDI ID No. PA-00291
DER ID No. 35-26

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

APRIL 1979

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: Summit Lake
NDI ID NO.: PA-00291 DER ID NO.: 35-26

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	PLATES 2-4, NOT "AS-BUILT"
REGIONAL VICINITY MAP	SEE PLATE 1
CONSTRUCTION HISTORY	BUILT CIRCA 1875 - EARTH EMBANKMENT WITH TIMBER SPILLWAY 1884 - DAM RAISED AND MASONRY CONSTRUCTED 1910 - SPILLWAY CREST RAISED 1943 - SPILLWAY CREST LOWERED TO ORIGINAL EL.
TYPICAL SECTIONS OF DAM	SEE PLATE 3
OUTLETS: Plan Details Constraints Discharge Ratings	SEE PLATE 3

A-1

ENGINEERING DATA

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	NONE
DESIGN REPORTS	NONE
GEOLOGY REPORTS	1914 PENNSYLVANIA WATER SUPPLY COMMISSION
DESIGN COMPUTATIONS: Hydrology and Hydraulics Dam Stability Seepage Studies	ONLY HYDRAULICS AND HYDROLOGY ESTIMATES: 1914 AND 1946 BY PENNSYLVANIA WATER SUPPLY COMMISSION 1943 - THOMAS WIGGIN, CONSULTING ENGINEER
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	NONE
POSTCONSTRUCTION SURVEYS OF DAM	DATE UNCERTAIN, SURVEY AS SHOWN ON PLATE 3

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	NOT AVAILABLE
MONITORING SYSTEMS	NONE
MODIFICATIONS	SEE CONSTRUCTION HISTORY
HIGH POOL RECORDS	NONE
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	1943 - SPILLWAY STUDY by Thomas Wiggin, CONSULTING ENGINEER
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	NONE

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	NOT AVAILABLE
SPILLWAY: Plan Sections Details	SEE PLATE 4
OPERATING EQUIPMENT: Plans Details	SEE PLATE 3
PREVIOUS INSPECTIONS Dates Deficiencies	1919 - SLIGHT SEEPAGE AT OUTLET 1925 - SPILLWAY APPROACH WALL NEEDS RELAYING. GROUND ALONG DOWNSTREAM WALL IS SWAMPY - FROM DRAIN 60' LEFT OF DAM. SLIGHT SEEPAGE AT OUTLET. 1928 - SEEPAGE AT DOWNSTREAM TOE OF WALL. SPILLWAY ABUTMENTS NEED REPOINTING. 1931 - SLIGHT SEEPAGE PER 1928 1934 - SEEPAGE AT LEFT END.
	1941 - NO DEFICIENCIES 1943 - NO DEFICIENCIES 1945 - NO DEFICIENCIES 1953 - SPILLWAY NEEDS REPOINTING. 1957 - DEBRIS IN OUTLET CHANNEL.

SUSQUEHANNA RIVER BASIN

SUMMIT LAKE CREEK LACKAWANNA COUNTY

PENNSYLVANIA

SUMMIT LAKE DAM

NDI ID No. PA-00291
DER ID No. 35-26

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

APRIL 1979

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: SUMMIT LAKE County: LACKAWANNA State: PENNSYLVANIA

NDI ID No.: PA-00291 DER ID No.: 35-26

Type of Dam: EARTHFILL W/ DOWNSTREAM MASONRY Hazard Category: HIGH

Date(s) Inspection: OCTOBER 26, 1978 Weather: RAIN Temperature: 55°F±

SOIL CONDITIONS - WET

Pool Elevation at Time of Inspection: 1376.0 msl/Tailwater at Time of Inspection: SMALL FLOW IN STREAM msl

Inspection Personnel:

D. WOLF (GFCC) V. CARROL (PGW)

D. EBERSOLE (GFCC)

J. BORDNAR (PGW)

A. WHITMAN (GFCC) Recorder

B-1

EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NONE	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	NONE	
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	NONE	
CREST ALIGNMENT: Vertical Horizontal	SEE PLATE 1 AND SURVEY INFORMATION FOLLOWING	
RIPRAP FAILURES	RIPRAP WASHED OUT IN AREAS. RIPRAP DOES NOT EXTEND TO TOP OF DAM	

B-2

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	NO DEFICIENCIES	
ANY NOTICEABLE SEEPAGE	NONE	
STAFF GAGE AND RECORDER	NONE	
DRAINS	NONE	
GRASS AND BRUSH	UPSTREAM OF MASONRY WALL - SOD IS EXCELLENT. DOWNSTREAM OF MASONRY WALL - SMALL TREES AND DEBRIS	A FEW BURROWING ANIMAL HOLES OBSERVED IN DOWNSTREAM EMBANKMENT.

~~CONCRETE~~/MASONRY DAMS

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	NONE	
JUNCTION OF STRUCTURE WITH: Abutment Embankment Other Features	NO DEFICIENCIES	
DRAINS	NONE	
WATER PASSAGES	SEE OUTLET WORKS	
FOUNDATION	NOT OBSERVABLE	

CONCRETE/MASONRY DAMS

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MASONRY ~~CONCRETE~~ SURFACES: Surface Cracks Spalling	NONE	
STRUCTURAL CRACKING	NONE	
ALIGNMENT: Vertical Horizontal	SEE PAGE B-11	
MONOLITH JOINTS	N/A	
MASONRY ~~CONSTRUCTION~~ JOINTS	MORTAR DETERIORATED	
STAFF GAGE OR RECORDER	NONE	

B-5

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	CIP - NOT VISIBLE	
INTAKE STRUCTURE	FLOODED by POOL LEVELS SLIGHTLY OVER SPILLWAY CREST	BRIDGE TO STRUCTURE IS BELOW TOP OF DAM AND IS IN FAIR CONDITION - VANDALISM AND ICE.
OUTLET STRUCTURE	MASONRY OUTLET NOT VISIBLE BECAUSE OF WATER DEPTH.	NO DEFICIENCIES.
OUTLET CHANNEL	NO DEFICIENCIES.	
EMERGENCY GATE	IN OPERATION ON THE DAY OF INSPECTION	NO DEFICIENCIES.

UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
~~CONCRETE~~ WEIR (MASONRY CONTROL SECTION)	BOTTOM IS CRACKED WITH A 1'x3' AREA ERODED	WHAT APPEARS TO BE A CONCRETE CUTOFF WALL IS VISIBLE UPSTREAM OF CONTROL SECTION.
APPROACH CHANNEL	LOOSE AND IRREGULAR ROCK ON BOTTOM	MORTAR IN WALLS IS DETERIORATED.
DISCHARGE CHANNEL	MASONRY CASCADE DETERIORATED MORTAR SAGGING IN MIDDLE.	
BRIDGE AND PIERS	NONE	

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	NONE	
OBSERVATION WELLS	NONE	
WEIRS	NONE	
PIEZOMETERS	NONE	
OTHER	NONE	

RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	GENERALLY MILD	
SEDIMENTATION	NO OBSERVED OR REPORTED PROBLEMS.	
WATERSHED DESCRIPTION	SUBURBAN - RURAL DEVELOPMENT.	

DOWNSTREAM CHANNEL

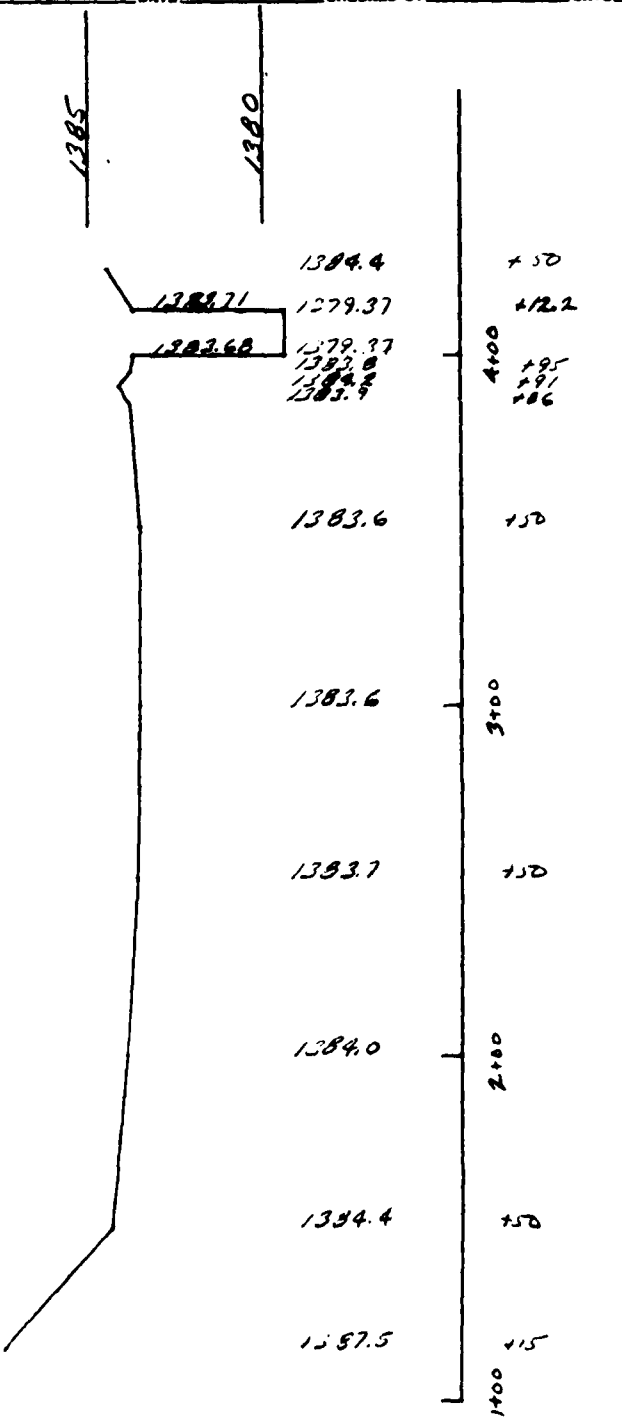
Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	NONE	
SLOPES	FAIRLY STEEP	
APPROXIMATE NUMBER OF HOMES AND POPULATION	TURKEY FARM IMMEDIATELY DOWNSTREAM. FURTHER DOWNSTREAM AT LEAST 5 HOUSES CLOSE TO STREAM.	

B-10

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

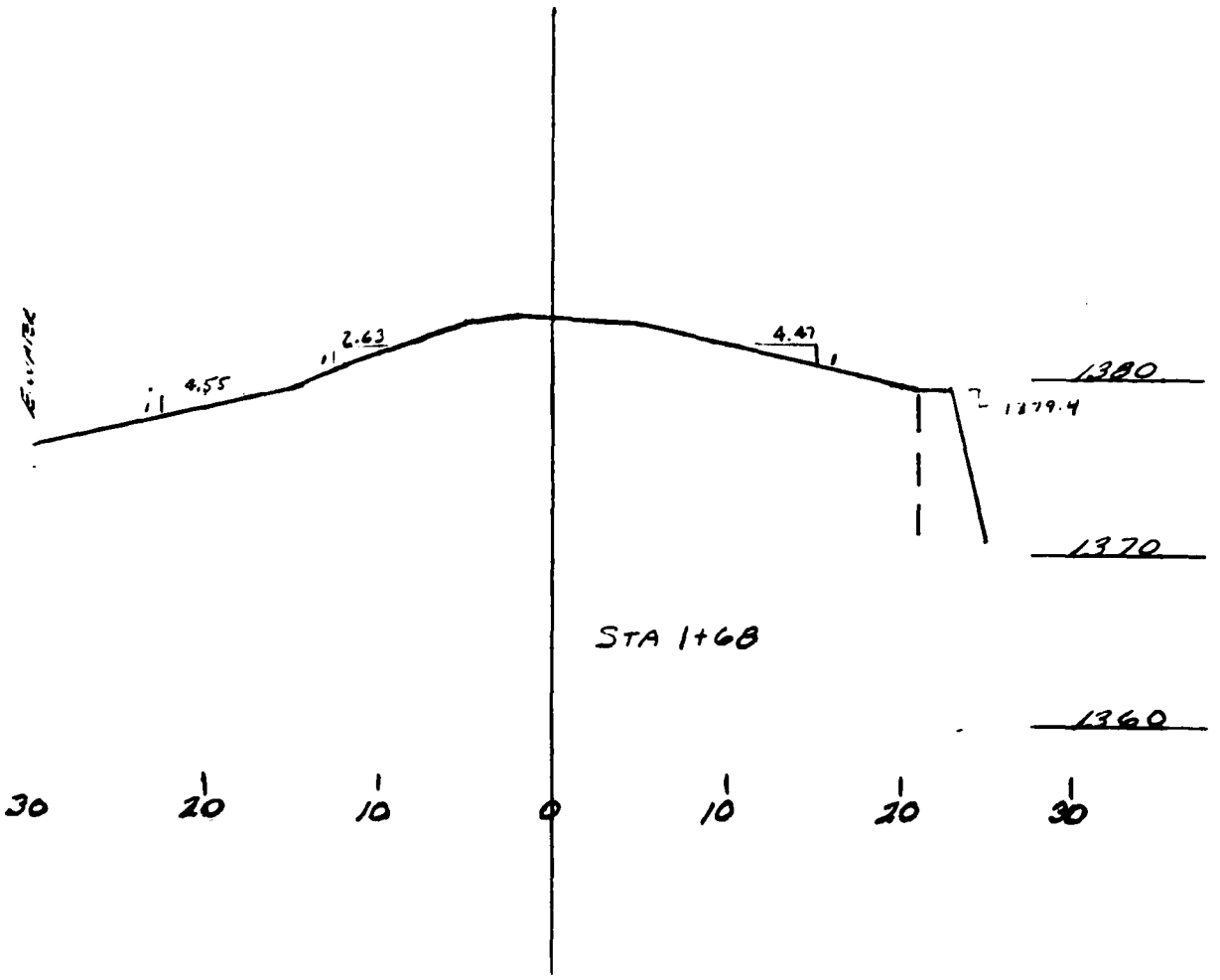
SUBJECT Summit Lake Dam FILE NO. 7832
Profile - Top of Dam SHEET NO. ___ OF ___ SHEETS
FOR
COMPUTED BY DRE DATE 12-8-78 CHECKED BY ___ DATE ___



B-11

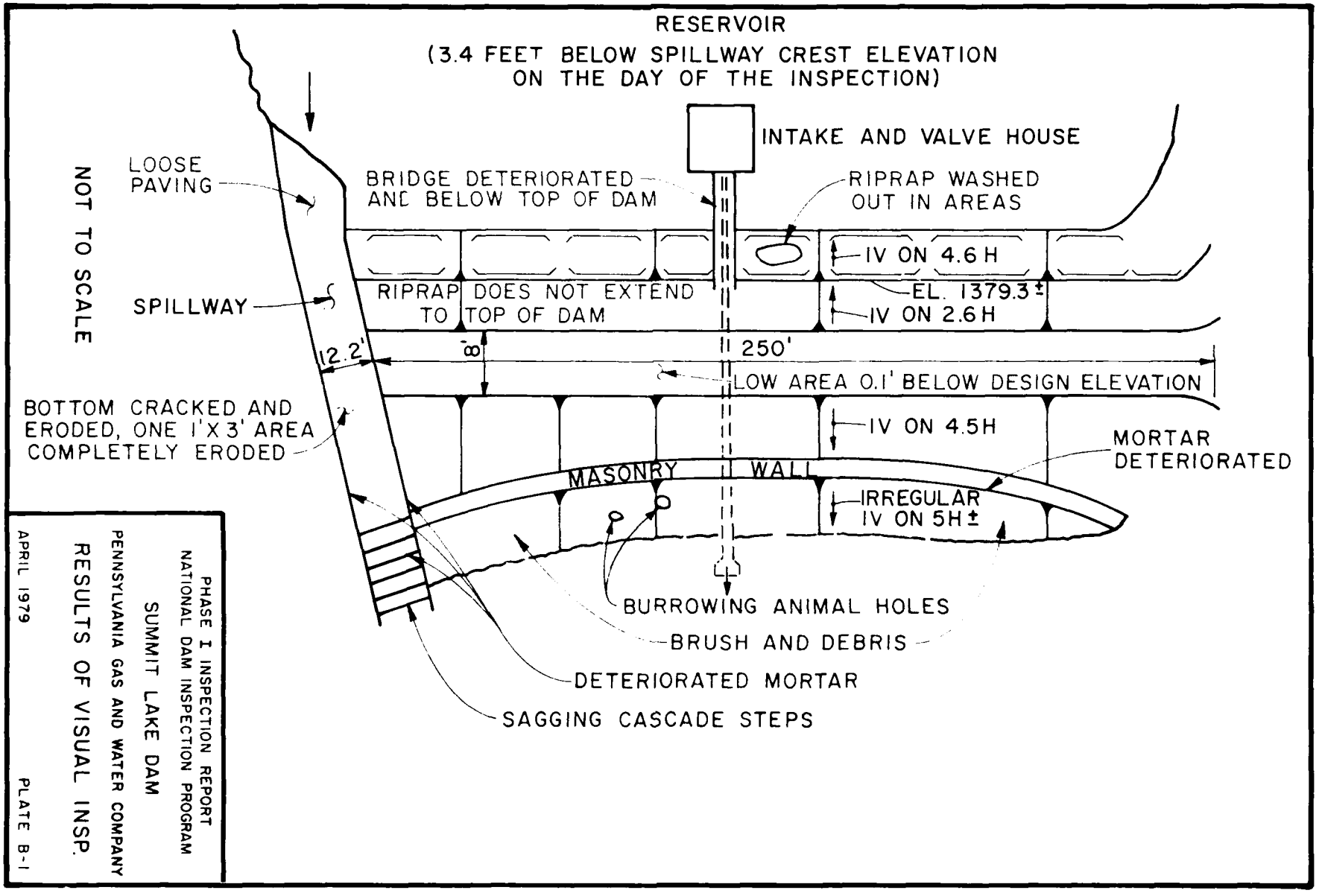
GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT SUMMIT LAKE DAM FILE NO. 7832
SECTION - EMBANKMENT SHEET NO. ___ OF ___ SHEETS
FOR
COMPUTED BY DRE DATE 12-8-78 CHECKED BY ___ DATE ___



SECTION

B-12


RESERVOIR
(3.4 FEET BELOW SPILLWAY CREST ELEVATION
ON THE DAY OF THE INSPECTION)
INTAKE AND VALVE HOUSE
LOOSE PAVING
BRIDGE DETERIORATED AND BELOW TOP OF DAM
RIPRAP WASHED OUT IN AREAS
IV ON 4.6 H
EL. 1379.3±
IV ON 2.6 H
SPILLWAY
RIPRAP DOES NOT EXTEND TO TOP OF DAM
NOT TO SCALE
12.2'
8'
250'
LOW AREA 0.1' BELOW DESIGN ELEVATION
BOTTOM CRACKED AND ERODED, ONE 1'X3' AREA COMPLETELY ERODED
IV ON 4.5H
MORTAR DETERIORATED
MASONRY WALL
IRREGULAR IV ON 5H±
BURROWING ANIMAL HOLES
BRUSH AND DEBRIS
DETERIORATED MORTAR
SAGGING CASCADE STEPS
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
SUMMIT LAKE DAM
PENNSYLVANIA GAS AND WATER COMPANY
RESULTS OF VISUAL INSP.
APRIL 1979
PLATE B-1

SUSQUEHANNA RIVER BASIN

SUMMIT LAKE CREEK LACKAWANNA COUNTY

PENNSYLVANIA

SUMMIT LAKE DAM

NDI ID No. PA-00291
DER ID No. 35-26

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

APRIL 1979

APPENDIX C

HYDROLOGY AND HYDRAULICS

APPENDIX C

HYDROLOGY AND HYDRAULICS

In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

(a) There is a high hazard to loss of life from large flows downstream of the dam.

(b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

(c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

APPENDIX C

SUSQUEHANNA River Basin

Name of Stream: SUMMIT LAKE CREEK

Name of Dam: SUMMIT LAKE

NDS ID No.: PA - 00291

DER ID No.: 35 - 26

Latitude: N 41° 28' 30" Longitude: W 75° 42' 50"

Top of Dam ~~(low spot)~~ Elevation: 1383.7

Streambed Elevation: 1359.9 Height of Dam: 24 ft

Reservoir Storage at Top of Dam Elevation: 927 acre-ft

Size Category: SMALL

Hazard Category: HIGH (see Section 5)

Spillway Design Flood: VARIES 1/2 PMF TO PMF
USE PMF, LARGE POPULATION DOWNSTREAM.

UPSTREAM DAMS

Name	Distance from Dam (miles)	Height (ft)	Storage at top of Dam Elevation (acre-ft)	Remarks
NONE				

DOWNSTREAM DAMS DATA FROM DER

MAPLE LAKE	1.1	17	20	DER 35-27
LA RUE	1.4	18	2.8	DER 35-28
	BOTH IGNORED IN ANALYSIS			

SUSQUEHANNA River Basin

Name of Stream: SUMMIT LAKE CREEK

Name of Dam: SUMMIT LAKE

~~NDS ID No.~~: _____

~~DER ID No.~~: _____

Latitude: N 41° 28' 30" Longitude: W 75° 42' 50"

DETERMINATION OF PMF RAINFALL

For Area A1

which consists of Subareas A1 of 1.3 sq. mile

_____	_____
_____	_____
_____	_____
_____	_____

Total Drainage Area 1.3 sq. mile

PMF Rainfall Index = 22.15 in., 24 hr., 200 sq. mile

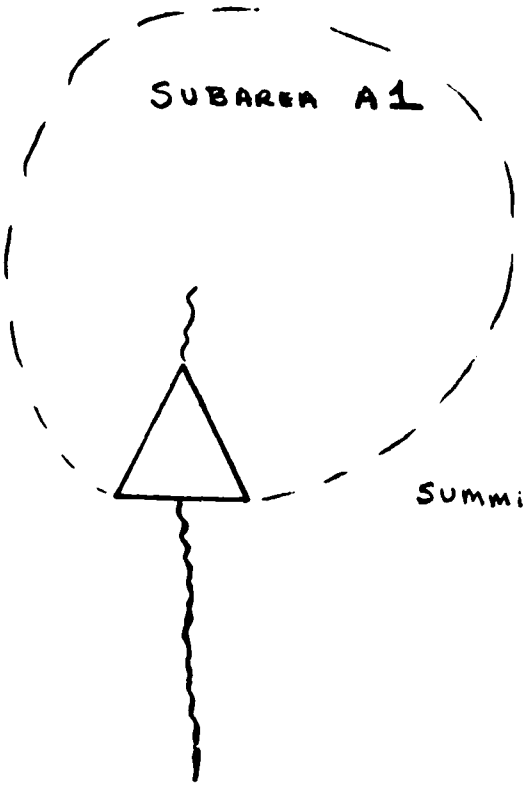
	Hydromet. 40 (Susquehanna Basin)	Hydromet. 33 (Other Basins)
Zone	N/A	N/A
Geographic Adjustment Factor	96%	1.0
Revised Index Rainfall	21.3	N/A

RAINFALL DISTRIBUTION (percent)

Time	Percent
6 hours	118
12 hours	127
24 hours	136
48 hours	142
72 hours	145
96 hours	N/A

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
_____ SHEET NO. _____ OF _____
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



SKETCH OF
SYSTEM

FOR LOCATION OF
DOWNSTREAM SECTIONS
SEE PLATE C-1

0313

Data for Dam at Outlet of Subarea A1
(see Sketch on Sheet C-4)

Name of Dam: SUMMIT LAKE Sheet 1 of __

Height: 24 FT. (existing)

Spillway Data:	Existing Conditions	Design Conditions
Top of Dam Elevation	1383.6	1383.7
Spillway Crest Elevation	1379.4	1379.4
Spillway Head Available (ft)	4.2	4.3
Type Spillway	RECTANGULAR	CONTROL SECTION
"C" Value - Spillway	2.7	2.7
Crest Length - Spillway (ft)	12.2'	12.2'
Spillway Peak Discharge (cfs)	284	294
Auxiliary Spillway Crest Elevation	NONE	NONE
Auxiliary Spillway Head Available (ft)		
Type Auxiliary Spillway		
"C" Value - Auxiliary Spillway		
Crest Length - Auxiliary Spillway (ft)		
Auxiliary Spillway Peak Discharge (cfs)		
Combined Spillway Discharge (cfs)	284≈290	294≈300

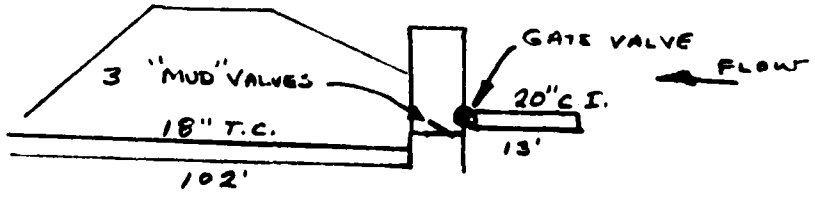
Spillway Rating Curve:

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)

Data for Dam at Outlet of Subarea A1

Name of Dam: SUMMIT LAKE Sheet 2 of __

Outlet Works Rating:	Outlet 1	~~Outlet 2~~	~~Outlet 3~~
Invert of Outlet	1360.0±	DOWNSTREAM OF STRUCT.	UPSTREAM OF STRUCT.
Invert of Inlet	1361.8	____	____
Type	SEE BELOW	TILE CLAY	C.I.
Diameter (ft) = D	____	1.5	1.66
Length (ft) = L	____	102	13
Area (sq. ft) = A	1.78	1.78	2.18
N	____	.013	.014
K Entrance (ASSUMED CHAMBER LOSS)	____	0.2	0.5
K Exit	____	1.0	N/A
K Friction* = $29.1 N^2 L/R^{4/3}$	____	1.85	.24
Sum of K	3.65 =	3.05 +	.74 × $(\frac{18^2}{20^2})$ = .60 (SECTION CHANGE)
$(1/K)^{0.5}$ = C	0.57	____	____
Maximum Head (ft) = HM	27	____	____
Q = C A $\sqrt{2g(HM)}$ (cfs)	42	____	____
Q Combined (cfs)	42	____	____



* R = Hydraulic Radius = (Area/Wetted Perimeter) = D/4 for Circular Conduits.

Data for Dam at Outlet of Subarea A1

Name of Dam: SUMMIT LAKE Sheet 3 of ___

Storage Data:

Elevation	Area (acres)	Storage million gals	Storage acre-ft	Remarks
1344.5 = ELEVO*	0	0	0	
1379.4 = ELEV1	55.4 = A1	210	644.5 = S1	
1380	64			
1400 **	97			
1393.7	69.6		927	INTERPOLATED

* ELEVO = ELEV1 - $(3S_1/A_1)$

** Planimetered contour at least 10 feet above top of dam

Reservoir Area at ~~Top of Dam~~ Normal Pool is 6.6 percent of watershed.

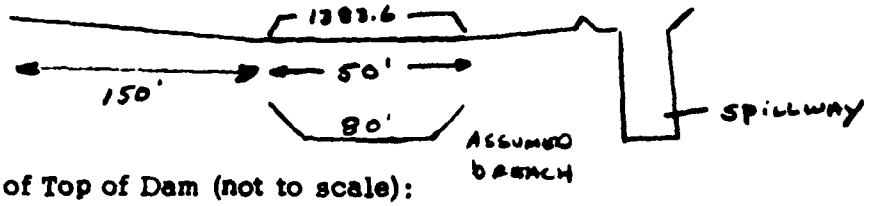
Remarks: ___

Data for Dam at Outlet of Subarea A1

Name of Dam: SUMMIT LAKE Sheet 4 of ___

Breach Data:

Sketch of Dam Profile (not to scale):



Sketch of Top of Dam (not to scale):

Soil Type from Visual Inspection: CLAY ON TOP

Maximum Permissible Velocity (Plate 28, EM 1110-2-1601) 2.5 fps
(from $Q = CLH^{3/2} = V \cdot A$ and depth = (2/3) x H) A: Lod

HMAX = $(4/9\ V^2/C^2)$ = .9 ft., C = 3.1

HMAX + Top of Dam Elev. = 1383.6 / 1383.9 = FAILEL
(Above is elevation at which failure would start)

Dam Breach Data:

BRWID = 80 ft (width of bottom of breach)

Z = 1 (side slopes of breach)

ELBM = 1360.0 (bottom of breach elevation, minimum of zero storage elevation)

WSEL = 1379.4 (normal pool elevation)

T FAIL = 6 mins

= 0.1 hrs (time for breach to develop)

SUSQUEHANNA River Basin

Name of Stream: SUMMIT LAKE CREEK

Name of Dam: SUMMIT LAKE

~~NDS ID No.:~~ _____

~~DER ID No.:~~ _____

Latitude: N 41° 28' 30" Longitude: W 75° 42' 50"

Drainage Area: 1.3 sq. mile

Data for Subarea: A1 (see Sketch on Sheet C-4)

Name of Dam at Outlet of Subarea: SUMMIT LAKE

Drainage Area of Subarea: 1.3 sq. mile

Subarea Characteristics:

Assumed Losses: 1.0-inch initial abstraction + 0.05 in/hr

The following are measured from outlet of subarea to the point noted:

L = Length of Main Watercourse extended to the divide = 1.25 mile

L_{CA} = Length of Main Watercourse to the centroid = 0.42 mile

From NAB Data: AREA 11, PLATE E

Cp = 0.62

C_T = 1.50

$Tp = C_T \times (L \times L_{CA})^{0.3}$ = 1.24 (hrs)

Flow at Start of Storm = 1.5 cfs/sq. mile x Subarea D.A = 2.0 cfs

Computer Data:

QRCSN = -0.05 (5% of peak flow)

RTIOR = 2.0

Remarks: _____

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

DATA FOR
LA-RUE DAM

0.36 ACRES, 727,800 gal @ 1156.3 (NORMAL)
TOP AT 1157.8
FREE BOARD NORMAL POOL TO TOP dam = 1.5'
SURCHARGE STORAGE =

$\frac{1}{3}(A_1 + A_2 + \sqrt{A_1 A_2})$ ASSUME $A_2 = 0.4$ ACRE

$\frac{1.5}{3}(0.36 + 0.4 + \sqrt{0.36 \times 0.4}) =$
0.57 ACRE-FT

NORMAL STORAGE = 2.23 ACRE-FT
TOTAL = 2.8 ACRE-FT ← TOTAL STORAGE
SPILLWAY LENGTH = 43.3'

MAPLE LAKE
SPILLWAY 19.3' LONG AT EL. 1247.8 2.36 ACRES 3.67 MG
TOP AT 1250.5
ESTIMATED AREA AT EL 1260.0 18.25 ACRES

AT 1250.5 4.0 = AREA IN ACRE 20 = STORAGE IN ACRE-FT

BOTH DAMS IGNORED IN ANALYSIS

↑ TOTAL STORAGE

SELECTED COMPUTER OUTPUT

ITEM	PAGE
MULTI-RATIO ANALYSIS	
INPUT	C-12
SYSTEM PEAK FLOWS	C-13
SUMMIT LAKE DAM	C-14
BREACH ANALYSIS (1) (2) 50% PMF	
INPUT	C-15 TO C-16
SYSTEM PEAK FLOWS	C-17
SUMMIT LAKE DAM	C-18
STREAM SECTIONS	C-19

(1) PLAN 1 - NO BREACH
PLAN 2 - BREACH IN DAM

(2) FIGURES VARY SLIGHTLY FROM MULTI-RATIO ANALYSIS BECAUSE OF DIFFERENT TIME INCREMENT USED.

8315

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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************
    1                A1                                  DAM INSPECTION-GFCC
    2                A2                                SUMMIT LAKE CREEK
    3                A3                                  SUMMIT LAKE DAM
    4                B     300        0       15        0        0        0        0        0       -4        0
    5                B1      5
    6                J       1        5        1
    7                J1      1       .5       .4       .3       .2
    8                K       0        1                                          1
    9                K1        RUNOFF INTO SUMMIT LAKE
   10                N       1        1      1.3               1.3
   11                P              21.4      118      127      136      142      145
   12                T                                                  1.0      .05              .066
   13                M    1.24     0.62
   14                X    -1.5    -0.05        2
   15                K       1        1                                          1
   16                K1        ROUTE THROUGH SUMMIT LAKE
   17                Y                                  1
   18                Y1      1                                                -1379.4        0
   19                $A      0     55.4       64       97
   20                $E1344.5   1379.4     1380     1400
   21                $S1379.4     12.2      2.7      1.5
   22                $D1383.6
   23                $L     50      120      200      265      295      295
   24                $V1383.6   1383.7     1384   1384.4     1385     1400
   25                K      99
```

C-12

1ST COL
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Summit
A
5

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00	RATIO 2 .50	RATIO 3 .40	RATIO 4 .30	RATIO 5 .20
HYDROGRAPH AT	1	1.30	1	4234.	2117.	1694.	1270.	847.
	(	3.37)	(	119.90)(	59.95)(	47.96)(	35.97)(	23.98)(
ROUTED TO	1	1.30	1	3910.	1554.	1038.	499.	211.
	(	3.37)	(	110.73)(	44.00)(	29.38)(	14.13)(	5.97)(

C-13

SUMMARY OF DAM SAFETY ANALYSIS

Summit Lake Dam

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1379.40	1379.40	1383.60
STORAGE	644.	644.	920.
OUTFLOW	0.	0.	284.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1386.28	2.68	1112.	3910.	9.00	41.25	0.00
.50	1385.04	1.44	1022.	1554.	6.50	42.00	0.00
.40	1384.67	1.07	995.	1038.	5.50	42.50	0.00
.30	1384.12	.52	957.	499.	4.00	43.25	0.00
.20	1382.85	0.00	869.	211.	0.00	43.75	0.00

41-C

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**********
* PACKAGE (HEC-1)
* JULY 1978
* VERSION  26 FEB 79
**********
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A1                                   DAM INSPECTION-GFCC
A2                                SUMMIT LAKE CREEK                    DAM F...    DAM BREAK
A3                              SUMMIT LAKE DAM
B     300          0         6         0         0         0         0         0        -6         0
J1      5
J       2         1         1
J1    .5
P       0         1                                                    1
K1        RUNOFF INTO SUMMIT LAKE
M       1         1       1.3                       1.2                                  1
P               21.3       118       127       136
T                                                                    1.0       .05                .066
W    1.26      0.62
X    -1.5     -0.05         2
K       1         1                                                    1
K1        ROUTE THROUGH SUMMIT LAKE
Y                                                   1         1
Y1      1                                                         -1379.4         0
SA      0      55.4        64        97
SE 1344.5   1379.4      1380      1400
SS 1379.4      12.2       2.7       1.5
SD 1383.6
SL     50       120       200       265       295       295
SV 1383.6  1383.7      1394  1384.4      1385      1400
SR     80         1      1360       .10  1379.4      1400
SB     90         1      1360       .10  1379.4  1383.9
K       1         2                                                    1
K1        STREAM SECT. 2
Y                                                   1         1
Y1      1                                                           -1
Yc    .03       .07       .09      1360      1400       .69      .021
Y7      0      1420       150      1400       320      1380       450      1360       700      1360
Y7    850      1390      1020      1400      1300      1420
K       1         3                                                    1
K1        STREAM SECT. 3
Y                                                   1         1
Y1      1                                                           -1
Y6    .09       .07       .09      1340      1380      1400      .016
Y7      0      1400       110      1380       280      1360       450      1340       550      1340
Y7    800      1360      1000      1380      1400      1400
K       1         4                                                    1
K1        STREAM SECT.4 (MAPLE LAKE-VERY SMALL-IN REACH)
Y                                                   1         1
Y1      1                                                           -1
Y6    .09       .07       .09      1260      1300      4100      .02
Y7      0      1400       700      1360       920      1300      1180      1260      1570      1260
Y7   1710      1700      1840      1340      2000      1400
K       1         5                                                    1
K1        STREAM SECT. 5   (LA RUE DAM-VERY SMALL-IN REACH)
Y
```

C-15

B summ.T 2

51	Y1	1						-1			
52	Y6	.09	.07	.09	1180	1220	2000	.07			
53	Y7	0	1300	200	1260	800	1200	850	1180	960	1180
54	Y7	1000	1200	1310	1240	1500	1300				
55	K	99									

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50
HYDROGRAPH AT	1	1.30 (3.37)	1	2147. (60.78)(
			2	2147. (60.78)(
ROUTED TO	1	1.30 (3.37)	1	1488. (42.13)(
			2	32643. (924.35)(
ROUTED TO	2	1.30 (3.37)	1	1487. (42.11)(
			2	32170. (910.96)(
ROUTED TO	3	1.30 (3.37)	1	1486. (42.07)(
			2	30568. (865.58)(
ROUTED TO	4	1.30 (3.37)	1	1457. (41.27)(
			2	22924. (649.15)(
ROUTED TO	5	1.30 (3.37)	1	1456. (41.22)(
			2	21654. (607.51)(

C-17

SUMMIT
11
B

SUMMARY OF DAM SAFETY ANALYSIS

Summit Lake Dam

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1379.40	1379.40	1383.60
STORAGE	644.	644.	920.
OUTFLOW	0.	0.	284.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1384.99	1.39	1019.	1488.	6.20	18.00	0.00

PLAN 2 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1379.40	1379.40	1383.60
STORAGE	644.	644.	920.
OUTFLOW	0.	0.	284.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	1383.98	.38	947.	32643.	.26	16.80	16.70

C-18

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1687.	1361.2	18.00

PLAN 2 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	32170.	1368.8	16.90

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1486.	1342.6	18.10

PLAN 2 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS

Summ
12
B

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1457.	1260.7	18.40

PLAN 2 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	22924.	1265.8	17.00

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1456.	1181.4	18.40

PLAN 2 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	21454.	1188.1	17.00

C-19

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

SUMMARY OF PERTINENT RESULTS
(DAM WITH EXISTING CONDITIONS)

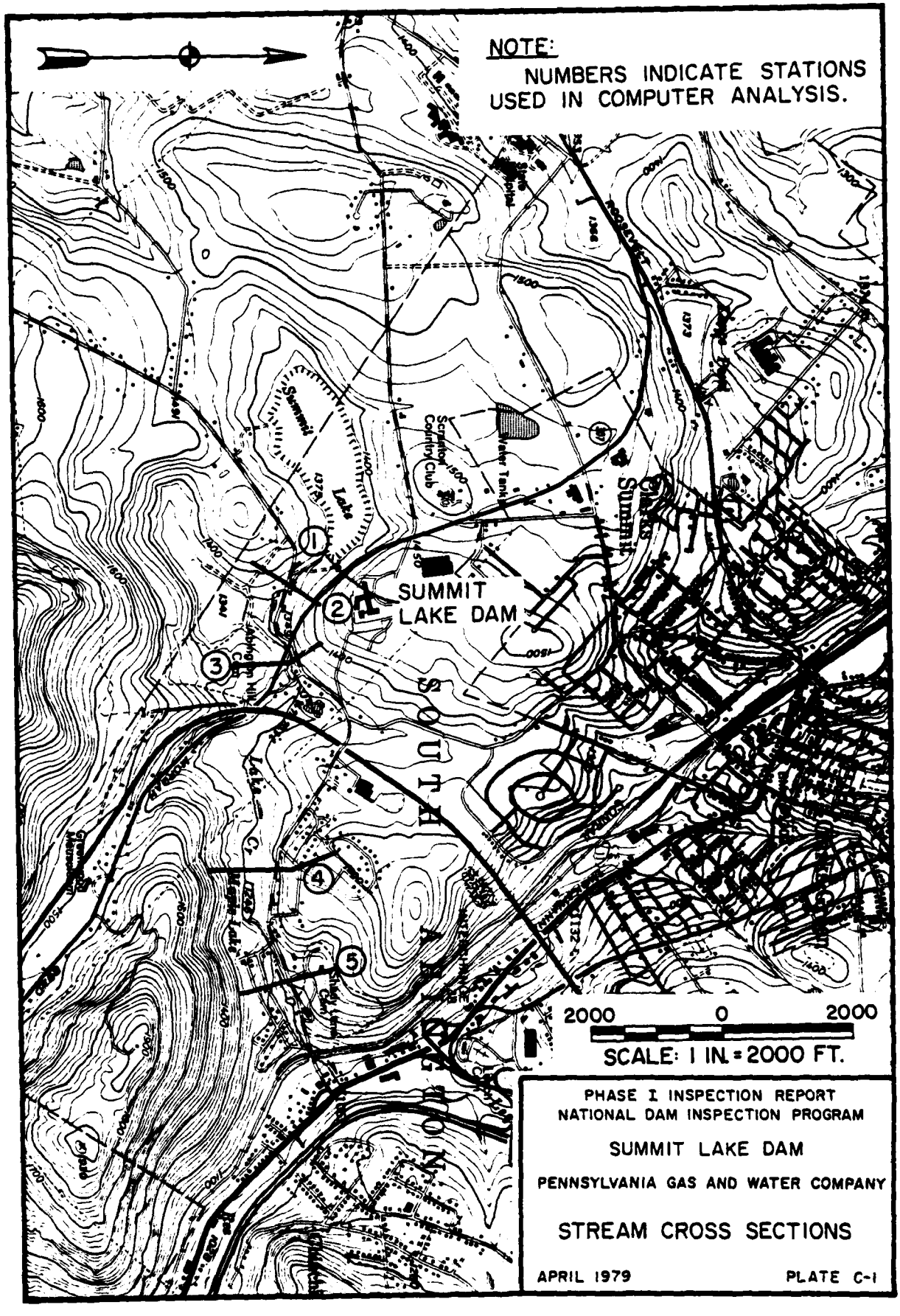
PMF RAINFALL = 24.71

	PMF	½ PMF
SUMMIT LAKE DAM		
RUNOFF (INCHES)	22.3	11.2
INFLOW (CFS)	4234	2117
OUTFLOW (CFS)	3910	1554
DEPTH OVERTOPPING (FT)	2.68	1.44
DURATION OVERTOPPING (HRS)	9.00	6.50

FROM BREACH ANALYSIS (½ PMF)

CROSS SECT NO.	← STREAM (FT) → DEPTH (NO FAILURE)	DEPTH (FAILURE)	Δ DEPTH FT
2	1.2	8.8	7.6
3	2.6	12.8	10.2
4	0.7	5.8	5.1
5	1.4	8.1	6.7

0313


NOTE:
NUMBERS INDICATE STATIONS USED IN COMPUTER ANALYSIS.
SUMMIT LAKE DAM
1
2
3
4
5
SOUTH
2000 0 2000
SCALE: 1 IN. = 2000 FT.
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
SUMMIT LAKE DAM
PENNSYLVANIA GAS AND WATER COMPANY
STREAM CROSS SECTIONS
APRIL 1979
PLATE C-1

SUSQUEHANNA RIVER BASIN

SUMMIT LAKE CREEK LACKAWANNA COUNTY

PENNSYLVANIA

SUMMIT LAKE DAM

NDI ID No. PA-00291
DER ID No. 35-26

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT

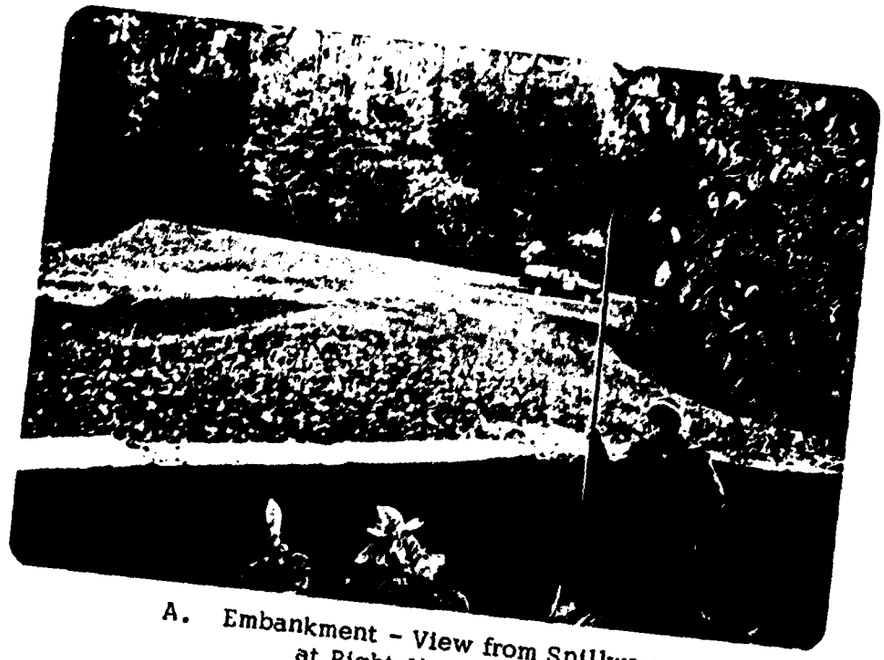
NATIONAL DAM INSPECTION PROGRAM

APRIL 1979

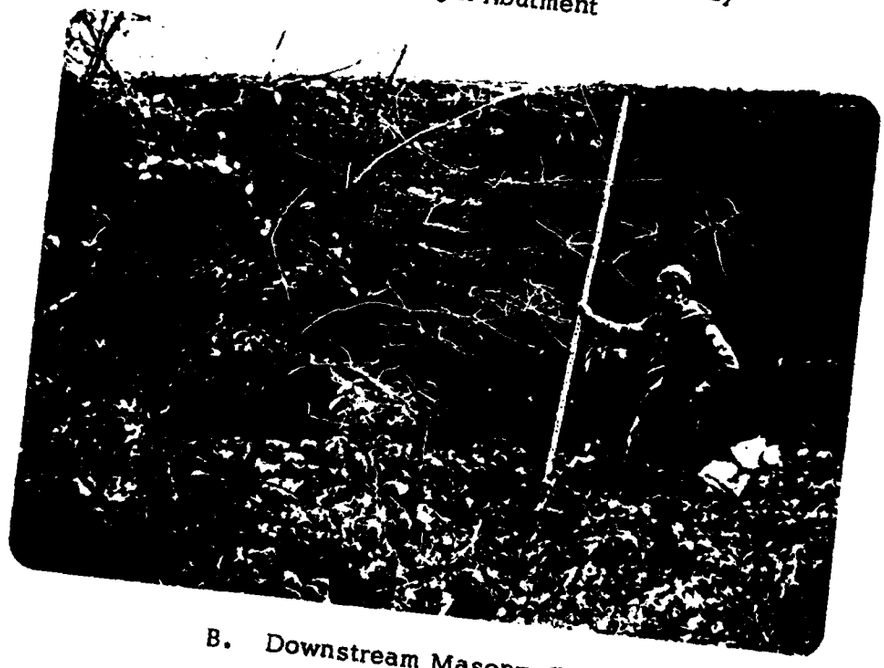
APPENDIX D

PHOTOGRAPHS

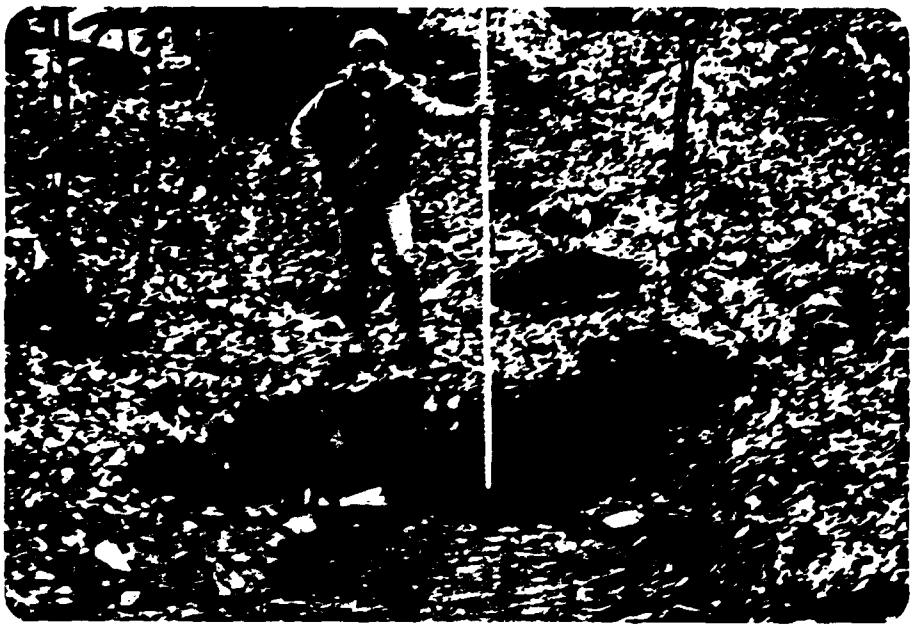
SUMMIT LAKE DAM



A. Embankment - View from Spillway at Right Abutment

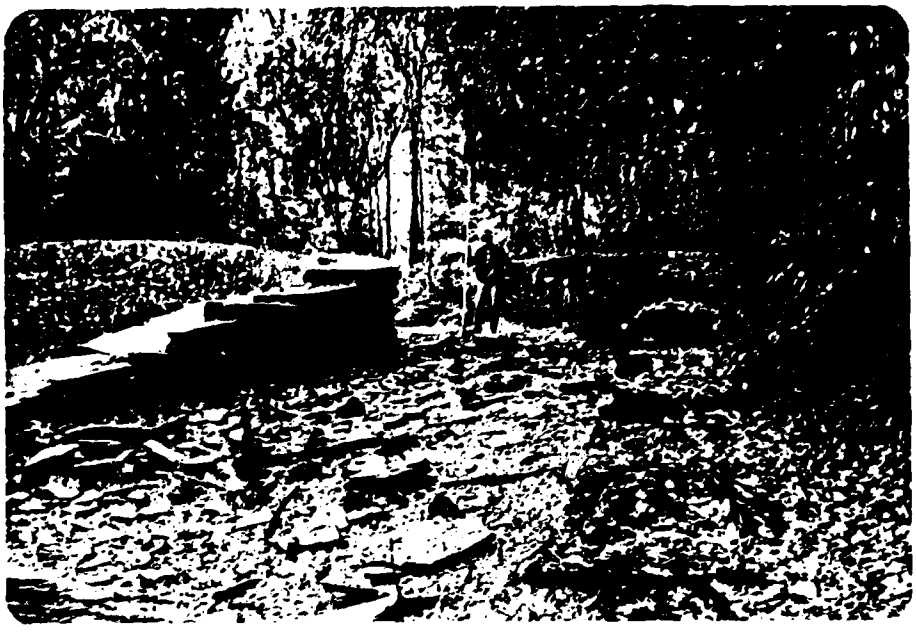


B. Downstream Masonry Face

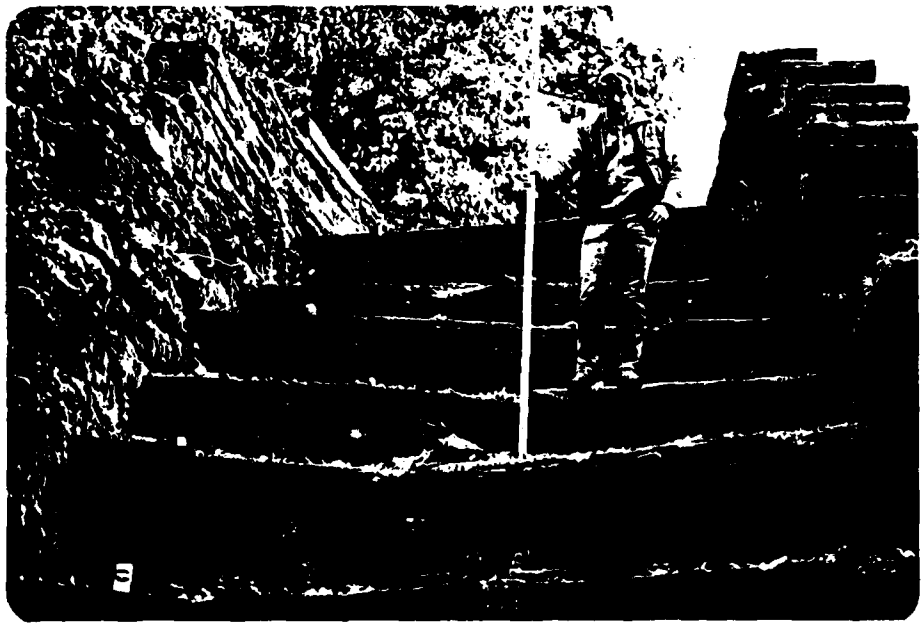


C. Outlet Works Outfall

D. Upstream Slope and Valve House



E. Spillway - Looking Downstream



F. Spillway Cascade

SUSQUEHANNA RIVER BASIN

SUMMIT LAKE CREEK LACKAWANNA COUNTY

PENNSYLVANIA

SUMMIT LAKE DAM

NDI ID No. PA-00291
DER ID No. 35-26

PENNSYLVANIA GAS AND WATER COMPANY

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

APRIL 1979

APPENDIX E

GEOLOGY

SUMMIT LAKE DAM

APPENDIX E

GEOLOGY

1. General Geology. The damsite and reservoir are located in Lackawanna County. Lackawanna County was completely covered with ice during the last continental glaciation of Pleistocene time. The general direction of ice movement was S 35° - 40° W. Glacial drift covers the entire County, except where subsequent erosion has removed it. Thick deposits of glacial outwash occur in many places along the Lackawanna River, and are 50 to 100 feet thick near Dickson, Scranton, and Moosic.

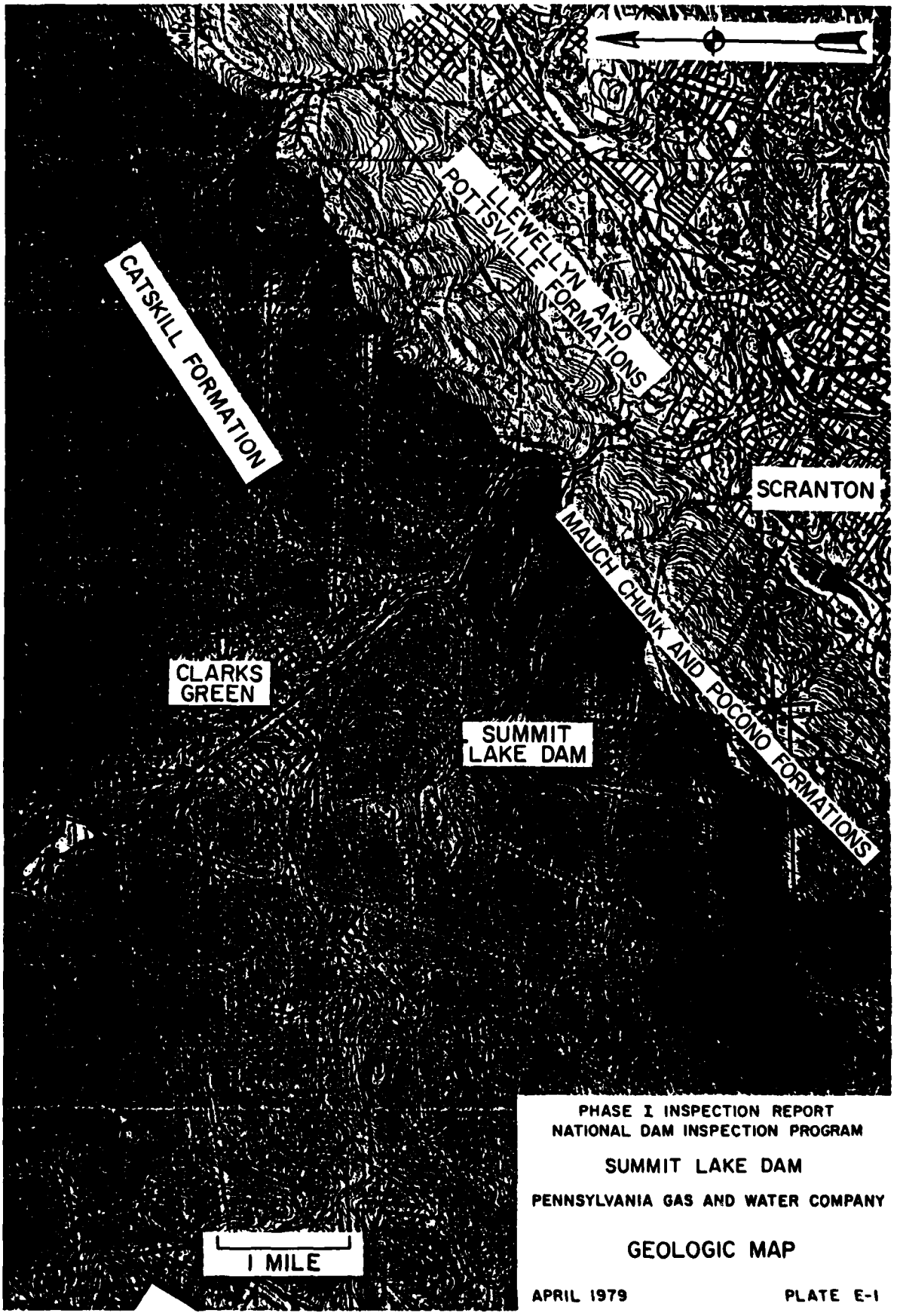
The only important structural feature in Lackawanna County is the Lackawanna Syncline, which traverses the County in a southwesterly direction. The syncline enters the County at the northeast corner as a narrow shallow trough, gradually deepens and broadens toward the southwest, and reaches its maximum development in Luzerne County. The rock formations exposed range from the post-Pottsville formations (youngest) through the Pottsville, Mauch Chunk shale, Pocono sandstone to the Damascus formation of the Catskill group (oldest). The rim rocks, the Pottsville formation and Pocono sandstone, have dips that rarely exceed 10° to 20° and form a rather simple syncline. The core rocks, the post-Pottsville formations, are folded into a series of minor anticlines and synclines which trend about N 70° E. The rocks in the northwestern and southeastern parts of the County, outside of the limits of the Lackawanna Syncline, are generally horizontally stratified.

The Lackawanna River, in general, follows the axis of the Lackawanna Syncline. Southeast of the Lackawanna River, the rise in terrain is quite gradual and the crests of the high mountains are several miles from the Lackawanna River. Streams, such as Roaring Brook, Stafford Meadow Brook, and Spring Brook, have cut deep canyons through the mountains and follow a torturous course to their confluence with the Lackawanna River near Scranton. Northwest of Lackawanna River,

the mountains rise abruptly to a sharp ridge which in most places is somewhat higher than the country to the northwest. Consequently, most of the drainage in this part of the County flows westward by way of Tunkhannock Creek. A few small tributary streams, however, such as Leggetts Creek, flow eastward from this area into Lackawanna River. In the area of interest, the Lackawanna River streambed is founded in post-Pottsville formations. Proceeding uphill from the river, the older Pottsville formation, Mauch Chunk shale, Pocono sandstone, and Catskill continental group are encountered in turn. The tributary streams, in flowing down the mountains, have generally cut through or around the hard sandstone and conglomerate members, and have eroded their streambed into the softer shales and glacial till. The Catskill continental group of rocks underlies the greater part of Lackawanna County.

2. Site Geology. Summit Lake Dam is founded on hardpan in the Catskill formation of late Devonian Age. The dam is situated on the Alleghany high plateau near the contact of the plateau and the valley and ridge province. Structure in the area is primarily that of a gently sloping dissected plateau. The Catskill formation is composed of dark red shale claystone, and siltstone; gray, fine to medium grained sandstone, and coarse grained conglomerates. Crossbedding, channeling and cut-and-fill features are common to the sandstone and conglomerate units. Siltstone predominates in the lower part of the formation. Bedding is generally well developed with thicknesses ranging from one foot to ten to sixteen feet in the coarser more competent beds.

The available records did not yield information pertinent to the foundation conditions at the damsite, other than describing the bedrock as hardpan.



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

SUMMIT LAKE DAM

PENNSYLVANIA GAS AND WATER COMPANY

GEOLOGIC MAP

APRIL 1979 PLATE E-1